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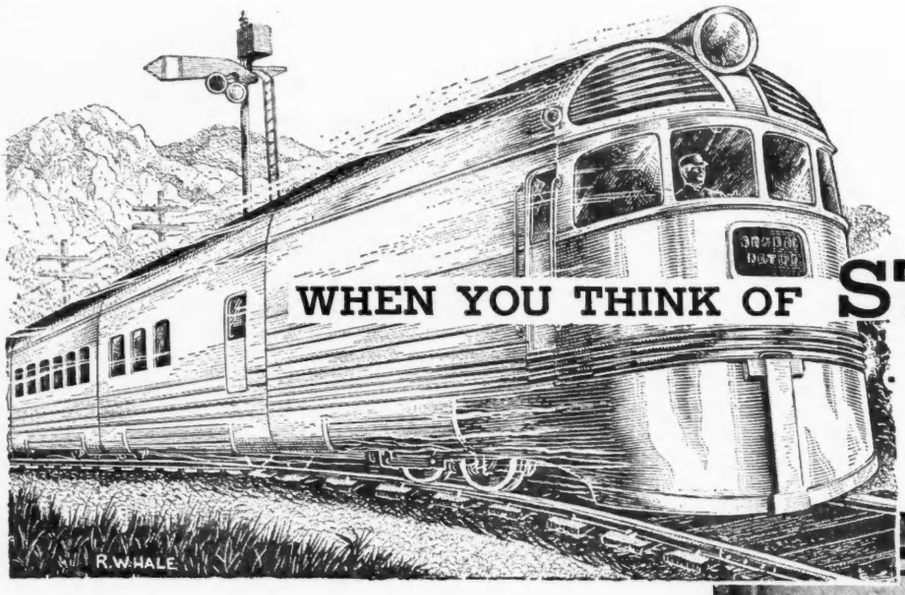

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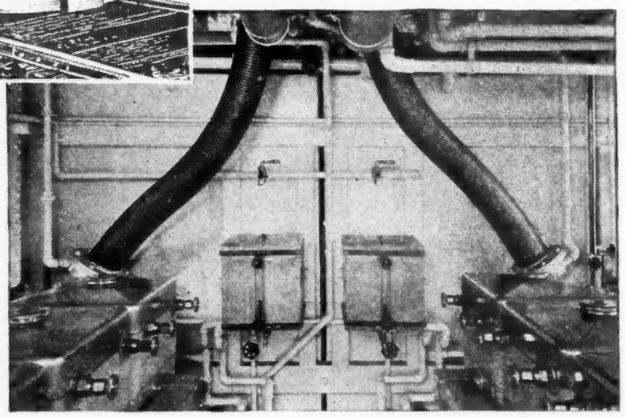
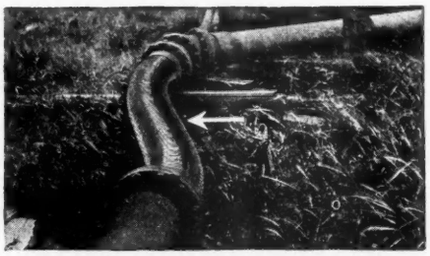


These Diesel exhausts have seen 10 years continuous service. They are fume tight, resistant to high temperatures and exhaust gases, and flexible to absorb vibration.

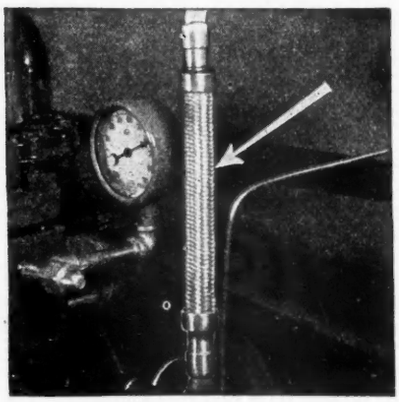
When design engineers sought the ideal balance of safe strength with light weight that made development of modern "streamliners" possible, they naturally found their answer in new METAL alloys.

Similarly, wherever flexible hose or tubing finds application in your plant, or as an integral part of the equipment you manufacture, the many specialized types of Flexible METAL Hose and Tubing offer you the obvious advantages of METAL strength . . . plus true flexibility, long life, ability to withstand heat, pressure, vacuum and the destructive action of many gases and liquids.



This 10" Flexible METAL Hose section (installed 13 years ago) absorbs vibration, prevents breaks in this gasoline and oil tanker unloading line. Previously the line frequently broke at this point.

Just how these important modern developments are serving industry in many fields . . . and how they can help you to reduce operating and manufacturing costs . . . is discussed fully in our newly published "Fact Book". We shall be glad to send your copy . . . without obligation . . . on request.



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Published Weekly
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AUTOMOTIVE INDUSTRIES

Vol. 80, No. 7
February 18, 1939

Bargain Counter Sales Write "Finis" to Pierce-Arrow Plant

Liquidation Proceedings End History Of One-Time Leader in Auto World

The last chapter of the history of the once great Pierce-Arrow Motor Corp. is being written down with a five-and-ten-cent sale in the quiet of the huge plant once alive with men at work.

Geometric dies, drills, gauges, once valued in the millions, now are racked on what resembles a notions counter.

Inked pots and the pens that signed million-dollar checks, desk chairs once occupied by men like Col. Charles Clifton and John C. Jay, filing cabinets that held orders from every part of the world, all voiceless witnesses to the passing of a great company, stand marked at bargain prices.

Pierce-Arrow is being sold piecemeal. Its 12 buildings, 44-acre plant which housed more than 10,000 employes with a payroll that in 1918 topped $15,000,000, now is being liquidated by the 1695 Elmwood Ave. Corp., formed by the Marine Trust Co. and Federal Reserve Bank to buy in the property and equipment at the bankruptcy sale.

Bulk of the purchases is being made by former employes who come in to reminisce about the days when Pierce Arrow was humming with thousands of orders, custom-built cars for Fatty Arbuckle, Clara Kimball Young, Warner Baxter—and the usual order from the White House for the President.

They still talk about the deluxe, custom-built Pierce for the Shah of Persia. Its fittings mounted with gems, solid gold trimming on the dashboard, the Shah's crest prominently displayed on the tonneau, the car was a three-day wonder on the showroom floor.

Three men were responsible for the growth of Pierce-Arrow from a small bird cage and bicycle manufacturing plant to the top of a business destined to be the nation's greatest industry. Col. Clifton, the salesman extraordinary, George K. Birge, the financial wizard, and Henry May, the production expert, combined their skills to bring about an organization of mechanical genius and business acumen probably never since equalled in Buffalo.

But in 1916, when the company's annual income was exceeding $5,000,000 and the Allies were buying Pierce trucks as fast as they could be produced, Birge felt that the company was too closely held.

He sent to New York for a banking house to handle a transaction of $16,000,000, exchange the old stock for new, recapitalize the company and list Pierce-Arrow on the New York Stock Exchange. Birge stepped out of the pic-

(Turn to page 176, please)

Italian Fiat Plant "Practically" Complete

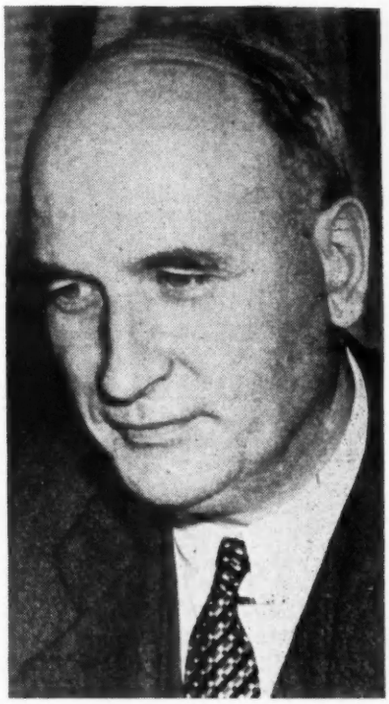
Announcement by the Department of Commerce, Automotive - Aeronautics Trade division, of the receipt of a report from the American Commercial Attache in Rome indicates that the new Fiat plant on the outskirts of Turin, Italy, is practically completed, though only partially in operation. This project, started in May, 1937, is reputed to be the largest and most complex industrial undertaking ever attempted by any Italian company.

Announced as the chief aim of the new plant is the furtherance of Italy's self-sufficiency program (discussed in the Jan. 14 issue of AUTOMOTIVE INDUSTRIES). Fiat accounts for more than 90 per cent of all the automotive vehicles produced in Italy.

The plant occupies an area of 25,000 acres. Vastness and compactness are said to be definite qualities of the general design; concentrating in a single building on a single floor as many processes as possible. The arrangements of the various workshops are aimed to reduce as far as possible the handling and movement of materials.

C. H. Hanna

Charles H. Hanna, 68, secretary of Auburn Rubber Corp. and former official of the Auburn Automobile Co., died suddenly, Feb. 13, of acute indigestion.



WILLIAM O'NEIL

. . . . at the annual meeting of the General Tire & Rubber Co. was elected to his sixteenth consecutive term as president and general manager. Other officers reelected were: W. E. Fouse, vice-president and secretary; C. J. Jahant, vice-president; T. S. Shore, treasurer.

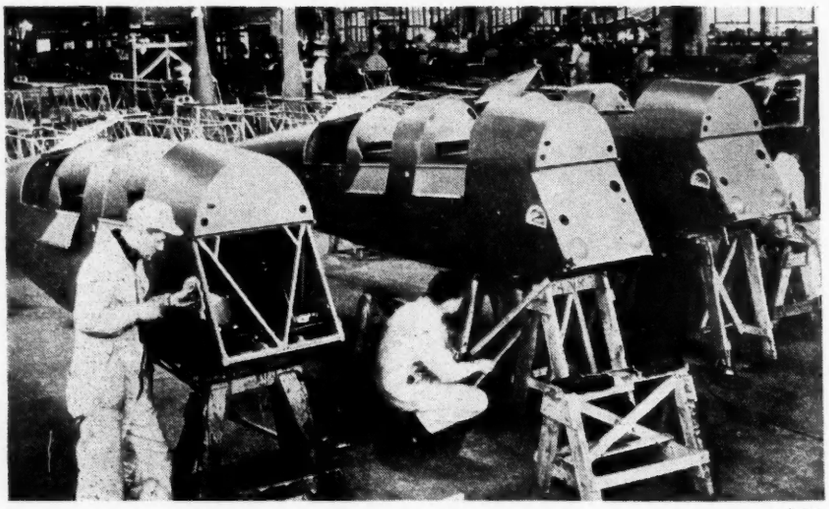
Output Believed Past Low Point

Week's Production Estimated 85,000

With car and truck production for the week ending Feb. 18 showing another gain over the preceding week, it has become increasingly evident that the seasonal decline will be less than originally anticipated and that the week ending Feb. 4 may very well have been the low point in the current winter's output.

According to a mid-week survey of factory schedules it is estimated that total production for the week will be more than 85,000 cars and trucks, an approximate gain of 3000 over the pre-

(Turn to page 177, please)



—Acme

Plane-a-Day

Expecting to complete an order, placed by the British Air Ministry, of 200 planes early in May, the Toronto branch of the DeHavilland Aircraft Co. is turning out a plane a day for the Mother Country. Here are a few of the completed fuselages undergoing inspection.

Wisconsin Association Votes For Registration Ban Repeal

Trade Group Feels Fair Trade Act Has Removed Objections to Publication

Wisconsin, the first and only state to prohibit publication of automotive vehicle registrations by a law enacted in 1937, is expected soon to remove the ban by repeal of this act and the enactment of a new law making it mandatory upon the registration department of the secretary of state's office to issue daily and weekly bulletins giving such information to all who may desire to receive it.

The Wisconsin Automotive Trades Association, which was principally responsible for the passage of the 1937 act, as well as an original law requiring dealers to secure licenses to do business in Wisconsin, as a fair trade practice measure, now feels that there is no use in withholding information concerning the issue of automobile vehicle licenses, since the fair trade act is taking care of the objections originally made.

A mail vote taken by Louis Milan, executive secretary of the association, found a majority of dealer members in favor of the resumption of the publication of registration. The ballot was taken because at a convention of the association last fall, there developed a close division of opinion. Secretary Milan, in asking for the vote, said:

"It will be recalled that at the last session of the Wisconsin Legislature a bill prohibiting daily and weekly automotive vehicle sales registrations was passed because of the manner in which factories were using this information in contacting dealers. For example, under threat of cancellation, the factory representative of one make of car would try and force a dealer to sell more cars if a competitor made more registrations in a particular day or week. The law was enacted before the coercion clauses of our present licensing law were enacted, which in turn prohibited factories or distributors from forcing unwanted merchandise on dealers or do any unfair act under threat of cancellation.

"In view of this coercion protection, many dealers now feel that daily and weekly registrations should again be made available because they are useful in following up prospects and in determining competitive sales.

"Dealers opposed to the proposed measure say that factories would again use registration figures as a club to secure registrations despite the coercion features of the licensing act."

Prior to the enactment of the law prohibiting the secretary of state from making generally available registration statistics, it was optional with his department to give out such information, with the exception of being required to furnish lists to law enforcement agencies in Wisconsin. The proposed law for the first time makes it mandatory to issue the information to all who may be concerned.

Secretary Milan is of the opinion that enactment of the proposed law will result in the development of a great deal of information valuable not only to factories, distributors and dealers, but as well to dealer associations and business papers of the industry, the latter having been for two years handicapped in reporting total sales of new vehicles by the absence of figures from Wisconsin.

Impressions seemingly general in the industry that the Wisconsin dealers' association was engaged in activities that are putting the factories "on the spot" are not based on fact, Secretary Milan pointed out. He said that the executive committee of the association has also been constituted a board of factory-dealer relations, which is in amicable mood to help the progress of the industry and themselves by friendly negotiations concerning disputes or misunderstandings.

Chrysler Reports On '38 Earnings

During the year ended Dec. 31, 1938, Chrysler Corp. sold 570,852 passenger and commercial vehicles and earned $18,798,293.65 after all charges, according to a report to stockholders this week. Earnings per share of common stock outstanding were $4.32. Dividends paid during the year aggregated $2 per share. Total sales for 1938 amounted to $413,250,511.70.

Chrysler Corp. continues to account for about one out of every four passenger cars sold at retail in the United States, it was said. New car registrations show that Plymouth, Dodge, De Soto, and Chrysler passenger cars delivered to the public at retail in the United States during 1938 totaled 472,565 units. Truck and commercial car sales to dealers for the same period totaled 56,425 units. Export shipments by the corporation totaled 59,407 units.

Directors, at a meeting on Tuesday, declared a dividend of $1 per share on the common stock of the corporation, payable March 14 to stockholders of record, Feb. 24.

Machine Tool Index

Machine tool orders placed in January brought the index slightly above December to 150.8 and extended the upward trend of the three months average to 136.5, well above the trend index of 129.6 a year ago, according to a report issued by the National Machine Tool Builders' Association. Especial signifiance was attached to continued strength in the domestic demand.

Navy Contract Awards

The Navy Department's Bureau of Supplies and Accounts has announced award of the following contracts:

Pratt & Whitney division of Niles-Bement-Pond Co.—grinding machine, $6,186.00; H. B. Underwood Corp.—bar, boring and equipment, $5,931.00; Aluminum Co. of America—pipe, tubing, rivets and shapes, aluminum alloy, $16,812.79; General Electric Co.—arc

welding machines, $34,300.00; Chapman Valve Mfg. Co.—valves, gate, composition, $9,433.00; American Car & Foundry Co.—plug cocks, $7,026.62; Charles Mundt & Sons—nickel-copper alloy, sheets, perforated, $11,454.80; United Aircraft Corp. (Hamilton Std. Propellers Div.)—aircraft propellers, $16,311.40.

England-France Top In U. S. Air Exports

Figures released by the State Department late last week show that licenses issued for the exportation of arms, ammunition and implements of war during January covered products valued at $6,271,030. The value of products included under licenses issued to Great Britain totaled $4,471,471 and exceeded the value of products licensed for shipment to all other countries. France was next with products valued at $150,244.

Exports of aircraft and related equipment, valued at $4,000,000, accounted for the bulk of war materials listed under the licenses issued to Great Britain. Aircraft parts valued at $305,769 was the largest single item listed under the license issued for exports to France.

The value of arms, ammunition and war implements actually exported during January were estimated at $4,630,587. Great Britain led in the value of these exports which were estimated at $1,553,199. France was next with exports valued at $1,289,746. Others were Argentina $219,396, Brazil $197,855, and Netherlands Indies $704,168.

Exports of aircraft and related parts made up the largest shipments to both Great Britain and France. Values were $1,126,604 and $1,250,000 respectively.

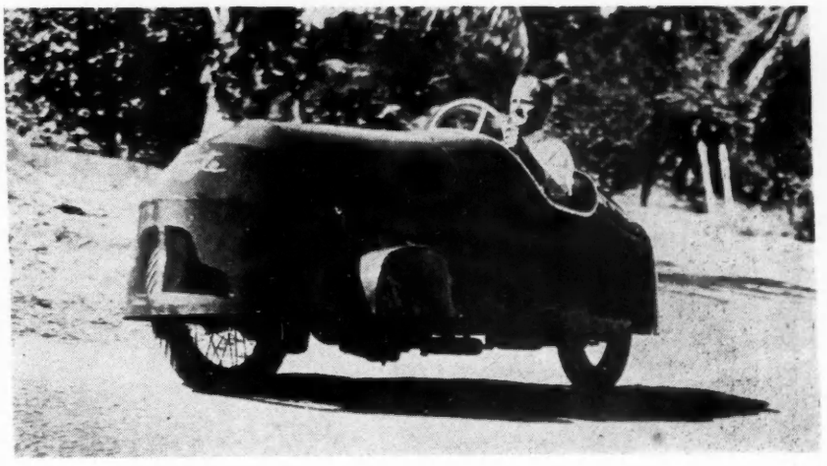
Menasco Financing Nears Completion

Plans for financing by Menasco Manufacturing Co. of Los Angeles, makers of airplane engines, are expected to be completed within a month, with an indicated contemplated offering of 100,000 shares to be offered at the prevailing market.

Stockholders, at the annual meeting held recently, approved an increase in the authorized stock to 75,000 shares from 500,000, all of which is outstanding. Of the authorized increase, a block of 25,000 shares was set aside to be sold to officers, employes and directors at the discretion of the board.

1939 Truck Show

The 1939 National Motor Truck show will be held at the Navy Pier in Chicago, Nov. 6-19, according to an announcement made by the convention bureau of the Chicago Association of Commerce.



Acme

Two Wheeler

Brain-child of J. G. Tingle, Miami, is this two-wheeled vehicle—cross between a motorcycle and an automobile. Mr. Tingle says it combines the features of the motorcycle, so far as traction is concerned, and the thrills of airplane flying because of the easy sway. The embryonic fender, seen on the side of the car, is one of a pair which conceal small "landing wheels" which, when let down, keep the car from toppling over on its side when it is at a standstill.

Japanese Board Move May Mean Larger Cars

Ford Boosts Delivery Price of Cars To Silence Competition Complaints

Small-Car Displacement to Be Raised

The Japanese Cabinet Planning Board is deliberating on a plan to raise the cylinder displacement limit of license- and tax-free small cars from 750 cc. to 1200 cc.

As the Army is vigorously endorsing the proposed revision of the engine specifications, the plan is believed to be certain of approval. Together with the cylinder displacement, the overall length of cars and other chassis measurements will also be revised.

When the revised specifications go in force Japan's famous baby-cars, which are said to be the smallest in the world with the exception of one Fiat and one Austin model, will be gradually replaced by medium-sized cars of the British and Continental European type.

Manufacture of the cars has already ceased, partly in expectation of the revision of the specifications, partly because of scarcity of materials.

Production of standard passenger cars and trucks, for which ample material is allotted by the control agencies, is advancing at a steady pace, with the capacities of the two largest makers rated at 20,000 each.

Ford Price Rise

The Ford Motor Company of Japan has recently received an import permit for a substantial shipment of chassis and parts whose assembly will keep the Yokohama plant busy until April. The license was issued at the request of the Army, which still needs a large number of imported cars in view of the greatly extended field of military operations in China.

Ford headquarters has notified authorized dealers in Japan that from the next deliveries Ford passenger cars will be priced 600 yen higher. It is believed that the American motor firm has decided on this increase (which amounts to $162 in American currency) in order to silence the complaints of Japanese makers that the Americans are maintaining their business by cut-throat competition. All around upward revision of list prices, by both Japanese and foreign firms, is already under way.

Diesel Output Held Up

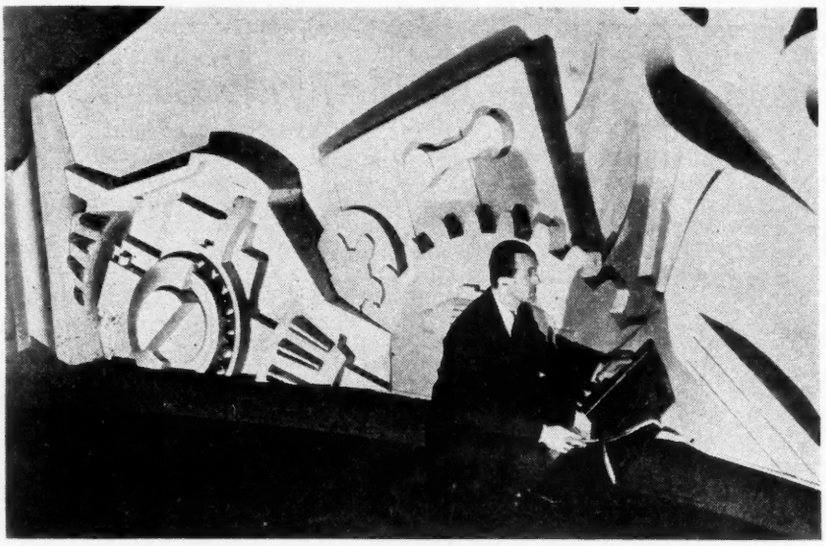
The Japan Diesel Engineering Co., a $5,000,000 subsidiary of the German Krupp-Junkers interests, has been unable to start production because of the lack of machine tools and the impossibility of importing them from Germany under the rigid import restrictions now in force.

Instead of building Diesel engines and cars, the firm will use a 2.5 million yen (approximately $681,500) loan from the Army to produce various undisclosed armament items.

U.S. Cars to Manchuria

Automobile importers in Manchuria are now placing orders direct with

(*Turn to page* 198, *please*)



Activated Mural

By means of what is believed to be the first activated mural ever built, the Ford Exposition at the New York World's Fair will demonstrate many applications of basic sciences in industry. Designed by Henry Billings, seen here, the mural graphically describes how solar energy is constantly being poured onto the earth in the form of heat and light; how industry, by controlling the channels through which this energy flows, harnesses its power to do the work of man. The completed mural will be 70 feet long and 30 feet high.

Labor Struggle May Lead to AFL Affiliation with Martin Faction

Martin Denies Possibility Despite Report AFL Is Closely Watching Convention Outcome

Although still largely in the speculative stage labor observers in Detroit and Washington have expressed opinions that the current struggle for control of the United Automobile Workers Union may very well result in a bid from the American Federation of Labor to the Homer Martin faction for reaffiliation; while the current move in Congress for amendment to the National Labor Relations Act also may have a strong bearing on the final outcome of the UAW contest.

Reports via Washington, from Miami, where the AFL council has been in session this week, indicate that the senior labor organization is keeping close tab on the UAW quarrel. Both William Green, AFL president, and Martin, however, have insisted that neither has approached the other relative to a reunion move although the AFL is said to be watching the actual outcome of Martin's March 4 convention before making any moves.

In Detroit, Martin has heatedly denied any such possibility, and in fact has issued a statement, probably for strategic purposes, in which he declared that he now wants the UAW to remain in the CIO. He also urged a referendum of the entire membership to determine whether he or R. J. Thomas, recognized as president by the CIO, should lead the UAW as a CIO affiliate. Thomas has countered with a statement pointing out that the present vote being taken by UAW locals on whether they would support Martin or his opposition was in effect a referendum. Spirited competition for support of the locals is expected to continue.

Informed observers feel that the outcome of the rival conventions will not settle the dispute and that the actual contest will come later when the courts must decide which faction is to be recognized as the UAW and which will be authorized to represent workers in the case of present contracts as well as future ones. With the strong likelihood that plant elections will have to be held in frequent instances to settle matters of that nature the entrance of the National Labor Relations Board is indicated. The fact that the complexion of that board, as well as the law under which it functions, are now being given serious consideration by Congress, may prove to be the really important factor in a solution of the future of automotive labor.

House Passes Plane Bill

Approving President Roosevelt's request for immediate construction of 3000 additional fighting planes for the Army Air Corps, the House of Representatives on Wednesday passed the May Bill by a vote of 367 to 15, it was reported.

The bill was passed after Majority Leader Sam Rayburn had voiced a warning that such an air armada might be needed "before the summer is over."

Men

At its annual board of directors meeting the following officers were re-elected by the National Wheel and Rim Association: **H. M. YOUNG**, president; **J. F. CREAMER**, vice-president; **S. M. STINE**, treasurer.

A. E. HACKETT, formerly with the Thomson - Gibb Co., has joined the Progressive Welder Co. in an executive capacity.

E. O. BOHNE, formerly with the Defiance Machine Works, has entered the employ of the Reed-Prentice Corp. as chief engineer in charge of engineering and development.

A. F. SCHOEPFLIN, formerly with the Doehler Die Casting Co., is now employed by Reed-Prentice Corp. as consulting engineer.

G. F. WALES, for the past 15 years chief engineer of the Buffalo stamping plant of the American Radiator Co., has resigned to devote his time to industrial product design and the management of the Strippit Corp., of which he is president and founder.

C. H. REY, for the past four years city sales manager for the Buick Detroit zone, has been named Washington zone manager.

Weelco Instruments Co. announces the appointment of **C. W. LUGAR**, formerly with the Minneapolis-Honeywell Co., to its Indianapolis territory.

W. E. HOLLER, general sales manager for Chevrolet, will be the guest speaker at the annual banquet of the National Automobile Dealers Association to be held in San Francisco on April 19.

Pierce-Arrow

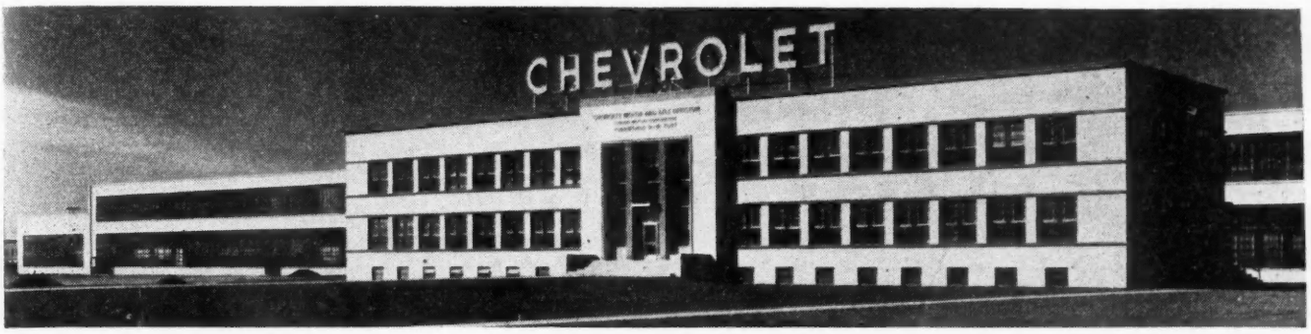
(Continued from page 173)

ture then, selling his 7000 shares at his asked price of $1,000 a share.

Henry May was the next to go. When Goethals & Co., industrial engineers, took over operation of the company and put into effect a management system that May felt unfair to his men, he resigned and left a gap never to be filled.

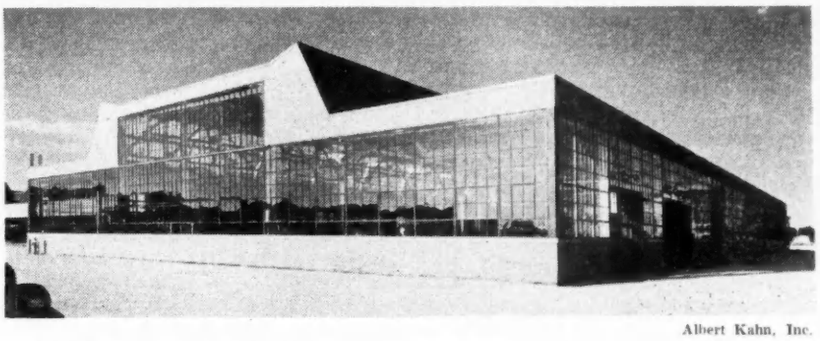
Martin C. Ewald, with the company more than 30 years, heads the liquidating firm. Tom O'Rourke, for a quarter of a century manager of sales to all parts of the world, supervises the sale of machinery and equipment.

John P. Cullen, another veteran, once the paymaster of the plant's 10,000 workers, makes out receipts for nickel and dime sales.



Architecture

These photographs of the administration building, Chevrolet Motor and Axle division, General Motors Corp., at Tonawanda, N. Y. (Top) and the Chrysler Export Building in Detroit are from the book "Industrial Architecture of Albert Kahn, Inc.", by George Nelson. These pictures serve well to illustrate the fact that pleasing appearance may go hand in hand with functional efficiency in the design of industrial buildings.



Albert Kahn, Inc.

Vote Against Truck Shows

Following the announcement that the New York Automobile Show will open in Grand Central Palace, New York, on Oct. 15, truck manufacturers in the Automobile Manufacturers Association declared against national motor truck shows by the following resolution:

"As the records over a period of three years prove conclusively that national motor truck shows, however well managed, are not sufficiently productive of either consumer or dealer interest or sales possibilities, the truck manufacturers in the Automobile Manufacturers Association hereby vote their opposition to shows of that character. However, the manufacturers will continue their customary procedure of making displays selectively at vocation and automobile shows."

Production

(Continued from page 173)

ceding week. With a week and a half still to go in February, the industry need only maintain its present pace to reach the total of 330,000 cars and trucks previously suggested as the month's total. February production to date has reached an estimated total of approximately 210,000 cars and trucks.

The week's increase can be credited largely to higher schedules at Oldsmobile, Studebaker and Nash as well as to the partial resumption of final assemblies in the Los Angeles and Toledo plants of Willys-Overland. There was little change, up or down, in the schedules of other manufacturers.

Although the spring selling season is still some distance away, a majority of manufacturers are planning intensive selling campaigns which will be launched on a nationwide basis as soon as the weather breaks. Several have already announced plans for their drives which will be preceded by meetings between dealers and field sales organizations as well as factory executives, and the result of these efforts will be reflected in March and April production schedules.

General Motors divisions were expected to contribute in excess of 33,000 cars and trucks to this week's total, followed by Ford and Chrysler with 22,000 and 21,000 respectively. Studebaker and Nash led the independents, followed by Packard, Hudson and Willys in that order.—J.A.L.

New Goodrich URW Contract

Successful conclusion of negotiations which have been conducted for over two months between the management of the B. F. Goodrich Co. and officials of the Goodrich local of the United Rubber Workers Union of the CIO, on a new labor contract with the Goodrich Co., was announced in Akron on Monday by L. L. Callahan, president of the union. When ratified the new pact will replace the original Goodrich-URW contract which legally expired Dec. 31, but which has remained in force pending the negotiations. The new pact will run until Dec. 31, 1939.

Declaring that the agreement incorporates several "worth-while improvements" over the contract which has been in force since last May, the union president indicated that the legislative committee will recommend acceptance, although, he said, the committee has not yet drafted its formal report.

Stewart Stockholders Vote for Liquidation

Stockholders of the 27-year-old Stewart Motor Corp., automobile truck manufacturer, voted immediate liquidation of the firm at a meeting on Tuesday. Thomas R. Lippard, retiring president, said it was explained that manufacturing operations had been unprofitable since 1931 and that banks had declined to grant an extension of a $657,000 loan.

Operation of the parts and service department, which employs seventy-five workers, will continue, Mr. Lippard said.

Robert P. Lentz, former vice president, was elected president to handle the liquidation. Fred J. Suttner, former sales manager, was chosen vice-president, and James Forsyth was reelected secretary-treasurer.

Buick Had Record Month in January

Buick sales for January broke all records for this month in the history of the company, it was announced by W. F. Hufstader, general sales manager. Retail deliveries of Buick cars by dealers in the United States totaled 12,977 units, the executive said, compared with the previous high of 11,285 cars, established in January, 1926.

Tire Prices Up

Firestone Tire & Rubber Co. announces price advance averaging two and one-half per cent on some passenger and truck tire lines, effective as of Feb. 15. Other manufacturers are expected to follow suit. The last price increase was in November, 1937.

"Clearing House" Sought For Public Relations

Industrialists Urge Organized Planning For Preservation of Enterprise System

Identifying public relations as industry's "Problem No. 1," 75 industrialists last week attended a closed meeting of the McGraw-Hill Public Relations Forum to discover a clear, simple definition of the problem applicable to all industry and to discuss ways and means of implementing that definition.

Paul Garrett, public relations director of the General Motors Corp., presented a definition of the job in hand, and Charles R. Hook, president of the American Rolling Mill Co., led the discussion of applying Mr. Garrett's definition to the broad field of industrial public relations.

"Good public relations is nothing more than good human relations multiplied endlessly," said Mr. Garrett. "Basic in the definition of our problem is an understanding of people. I mean people as they think now. I mean the philosophy of a people that for 150 years sought nothing so much as opportunity but who now, seemingly, seek nothing so much as security. Let us not quarrel with that. Let us, rather, give them the vision to see that, except through free enterprise and a free industry that prospers, there is no security and can be no security for the future."

In presenting a simplified definition of public relations work, Mr. Garrett urged industrial leaders to think in these human terms and measure their deeds by these human standards in setting their own houses aright. He urged that public relations begins at home, and that sound relations with employes, with customers and prospects and with the communities in which plants operate, must be the essence of any solution of the problem.

"We find ourselves in an era apparently where social values rank with economic values," he said, "where HOW a thing is done has assumed equal importance with WHAT is done. Translated literally, this means that it is no longer sufficient that industry provide merchandise in volume and at prices the public can afford to pay. Industry is also being asked to accomplish these results in a manner which will promote the social welfare of the community and of the nation.

Mr. Hook stressed the fact that the soundest and simplest definition of public relations can be applied successfully to the policies of a corporation only when the directing executives of that corporation apply that definition and the rules it implies, to their own thinking and conduct, honestly and openly.

"The preservation of the American incentive or private enterprise system today demands statesmanship on the part of all business executives," he said. We can no longer be merely manufacturers of steel, or automobiles, or paper. We must strive to become leaders, each in our own community. We must tell the story of industry and tell it effectively. Business has a real story to tell, a true story."

"The greatest contribution national business organizations can make today," said J. H. McGraw, Jr., president of the McGraw-Hill Publishing Co., "is to act as clearing houses for public relations ideas and methods, do the research and the teaching, and provide the background of fact and plan on which this work can be based. It is then for each of us to take that organized planning and thinking, add to it as much as our individual resources will permit, and then do the public relations job in our own back yard, with our own people in our own communities. If every corporation, large and small, were to do this job even reasonably well there would be no national problem. We would then enjoy public confidence and support, and the forces that now threaten the very existence of the enterprise system would disappear into thin air."

Assembly Cost

More than a million dollars an hour is spent to supply materials and parts to the assembly lines of the automobile factories when production is at its height, according to the Automobile Manufacturers Association. This is at the rate of $20,000 a minute.

Trains, trucks and steamships are constantly on the move with these supplies. In a busy year the intake represents purchase by the automobile manufacturers of as much as $2,250,000,000 in goods produced in factory and mine and on farm.

Returns to Marine Engine Production

After being out of the marine engine field since 1924, the Wisconsin Motor Co., Milwaukee, has resumed such manufacture, but in small sizes, compared with the heavy duty units formerly built. The new line ranges from single cylinder to four-cylinder engines from one to 35 hp., in relatively light air-cooled inboard engines for skiffs and rowboats up to some types of cabin cruisers. According to Harold Todd, president of Wisconsin, the line was first displayed at the New York motor board show in January with excellent reception. The manufacture of automotive and industrial type engines is being continued by the company.

Congressional Sentiment Trends Toward Revision of Wagner Act

Although Not Expected to Pass, Burke Bill Calculated to Have Effect on Lawmakers

Senator Edward R. Burke, Democrat of Nebraska and outspoken Congressional critic of the National Labor Relations Board, last week launched a bill to revise the Wagner Act, going further than the American Federation of Labor-Walsh bill would go, and including, among other provisions, one permitting employees to bargain collectively "free from threat, intimidation, restraint or coercion from any source."

Although the bill is generally regarded as having even less chance of passage than the Walsh measure, its introduction is calculated to have some effect upon sentiment rapidly crystalizing in Congress in the direction of Wagner Act revision. Senator Burke, a persistent critic of the NLRB, who was talking about Wagner Act changes long before most of the other members of Congress, described his measure as affording "a basis for constructive change in this very important piece of legislation."

The AFL, which has its own definite ideas about what should be done in the direction of revising the Wagner Act, has expressed opposition to the Burke measure along several specific lines. William Green, AFL president, issued a statement after the bill's introduction in which he protested against making the closed shop illegal, against the provisions which would ban "coercion from any source" and against the proposal to establish a board representing employes, employers and the public.

Even as Green was busy denouncing the Burke bill the CIO took to the wailing wall, vigorously assailing the Walsh bill sponsored by the AFL. The CIO mimeographs were set busy turning out statements by John L. Lewis and by CIO General Counsel Pressman, who described the AFL measure as "designed to foster company unionism and shackle American labor to the courts" and charging that the "Green-Walsh proposals go far beyond anything authorized or favored by the Houston convention of the AFL."

Publications

A bulletin by the RCA Manufacturing Co. describes its new **engine-indicator diagram equipment** developed for measuring rapidly changing cylinder pressures.*

Magnus Chemical Co., Inc., has just issued a new descriptive folder on its new product, Magnus No. 78, for **cold-process cleaning.***

Bulletin 331 of the Chain Belt Co., describes its Rex **coal and ash handling equipment.***

Four new catalogs have been made available by Westinghouse Electric & Manufacturing Co. One describes Westinghouse types SH and DH **speed reducers;** another describes the company's **single and multiple retort stokers;** the third is entitled "Simple Facts about **Synchronous Motors**"; and the fourth covers Westinghouse **geared drives.***

A paper on **engine operation in cold weather,** read by Dr. M. J. Zucrow of Spitzglass and Zucrow, consulting engineers, at a meeting of the Milwaukee Section S.A.E. in December, is being circulated by the Pines Winterfront Co., 1135 North Cicero Ave., Chicago.

A new eight page catalog section on its line of **heavy duty truck, bus and Diesel starting batteries** has just been issued by The B. F. Goodrich Co.*

The Caterpillar Tractor Co. has published a catalog describing its newly announced **R2 tractor.***

The Abrasive Co. announces publication of its abrasive grain data sheet No. 1 describing its **abrasive polishing grain.***

Farrel-Birmingham Co., Inc., has issued No. 30 in the series of booklets it is preparing. This latest is entitled **"Essential Steps in Halting the Long-Term Decline in Durable Goods Industry."***

A new catalog on **drill jig bushings** has been released by the Ex-Cell-O Corp.*

The Case-Hardening Service Co. is issuing a folder on its new **CHS carburizing salts for case-hardening.***

The following series of bulletins on electroplating has been issued by the R. & H. chemicals department of E. I. du Pont de Nemours & Co.: **Cadalyte "38", Electrotinning, Carbonate Remover, Electroplating Chemicals, Carburizing Salt, Accelerated Salt.***

A catalog containing full information on its complete line of **hose for all requirements** has been announced by The DeVilbiss Co.*

Mathews Conveyor Co. announces the third printing of its book, **"Natural Laws Applied to Production."***

A catalog insert covering its **hydraulic welding and punching equipment** has been published by the Progressive Welder Co.*

A booklet describing its **Motor Mile recording tachometer** has been announced by Stewart-Warner Corp.*

Changes in farm power and equipment—tractors, trucks and automobiles is the most recent study completed by the Works Progress Administration. The report, a booklet of 114 pages, may be obtained from Publication Section, Division of Information, WPA, Wash., D. C.

A **synthetic resin, Resistoflex PVA,** is described in a folder prepared by Resistoflex Corp.*

The Louis Allis Co. has prepared an 8-page booklet including general information on **NEMA standards and definitions and reference information on electric motors.***

*Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Plastic

A portion of the Bakelite Corp. exhibit for the New York World's Fair is the automotive display shown here. Parts of automobiles, in the construction of which plastic materials are used, are displayed. As the visitor presses a button under each part a transparency lights up, showing just where in the car that particular piece of mechanism is located.

Industrial Activity Reflects General Business Hesitation

An Exclusive and Regular Weekly Feature Written by the Guarantee Trust Co., N. Y.

Indicated trends in industrial activity last week continued to reflect the hesitation which has characterized general business throughout most of the year to date. The *Journal of Commerce* index of business for the week ended Feb. 4 stood at 84.7, as compared with 86.4 for the preceding week and 69.1 a year ago.

Reports of both wholesale and retail trade last week registered a measure of recovery from the effects of earlier unfavorable weather conditions. Department store sales in the week ended Feb. 4, according to the report of the board of governors of the Federal Reserve System, were 6 per cent below the corresponding 1938 level, as against a comparable decline of 1 per cent reported for the week before.

The decline in output of electricity by the light and power industry in the week ended Feb. 4 was slightly more than was to be expected on the basis of the usual seasonal trend, but production was 9.8 per cent above the comparable output last year.

Railway freight loadings in the same period, reversing the trend maintained in the preceding fortnight, declined to 576,790 cars, as compared with 594,379 cars in the preceding week and 564,740 cars a year ago.

Average daily production of crude oil in the week ended Feb. 4 was 3,441,950 barrels, and 193,700 barrels more than the average for the preceding week and 125,500 barrels more than that for the corresponding period last year. Current daily requirements, as computed by the U. S. Department of the Interior, amount to 3,220,000 barrels.

The average daily production of soft coal in the same week was 1,367,000 tons, as against 1,425,000 tons in the preceding week and 1,255,000 tons a year ago.

Engineering construction awards in the week ended Feb. 9 totaled $41,534,000, as compared with $59,036,000 in the preceding week, according to *Engineering News-Record.* Total contracts in the first six weeks of this year exceeded by 30.5 per cent the corresponding 1938 awards.

Lumber production in the week ended Feb. 4 was 5 per cent less than that reported for the preceding week, while shipments and new orders each registered a gain of 3 per cent.

The increase in cotton mill activity in the same period was less than the usual seasonal gain, as reflected in the decline of the *New York Times* adjusted index to 118.7 from 123.2 for the preceding week. A year ago the index stood at 87.2.

Professor Fisher's index of wholesale prices for the week ended Feb. 11 declined to 79.5 from the level of 79.8 reported for each of the three preceding weeks.

Reserves of member banks of the Federal Reserve System showed a further decline of $28,967,000 in the week ended Feb. 8. Estimated excess reserves declined $20,000,000 to a total of $3,460,000,000. Bills discounted by the Federal Reserve banks rose $2,521,000 to a total of $7,394,000.

Hearings in G.M. Case Moved To Boston, Continue Feb. 23

Ourselves and Government—A Check List Of Federal Action Corrected to Feb. 16

NATIONAL LABOR RELATIONS BOARD

NLRB has set aside the record of the proceedings arising out of a charge filed by Federation of Flat Glass Workers of America (CIO) alleging that Owens-Illinois Glass Co., Fairmont, W. Va., had engaged in unfair labor practices. The board further ordered a new hearing on the pleadings.

The NLRB has dismissed a complaint against the Timken-Detroit Axle Division, Wisconsin Axle Division, Oshkosh, Wis., in which the United Automobile Workers of America, had charged that the dismissal of William J. Eichorn constituted an unfair labor practice.

FEDERAL TRADE COMMISSION

VS. GENERAL MOTORS. Hearings will be moved from Brooklyn to Boston on Feb. 23, where respondents will continue testimony. Case involves the complaint that GM dealers allegedly are required to handle GM parts exclusively.

VS. GENERAL MOTORS CORP. AND OTHERS. Alleged unfair competition and practices tending to create monopoly in the sale of automobile parts, accessories and supplies. Hearings resumed Feb. 15 at Albany, N. Y. Trial examiner, William W. Sheppard; FTC attorney, Everett F. Haycraft.

The Federal Trade Commission report on manufacturer-dealer relationship in the automotive industry will be submitted to Congress in April. This was announced by Chairman Ferguson, of the Commission, in the course of recent hearings on the FTC Appropriation Bill.

VS. UNITED STATES RUBBER CO. Respondents have asked for additional time to reply to the complaint and have been given until March 1. The FTC alleges unlawful price discrimination in the sale of tires in violation of the Robinson-Patman Act. Also involved is the United States Tire Dealers Corp. of New York, a subsidiary.

F.O.B. PRICE CASE. Hearings are due in the Ford case but no specific date has been set. It had previously been fixed for Jan. 25 but was cancelled. The Commission is expected to close its case after the hearings. Date for GM hearings in Detroit has been fixed for Feb. 21. The FTC alleges in the proceeding that price advertising was misleading.

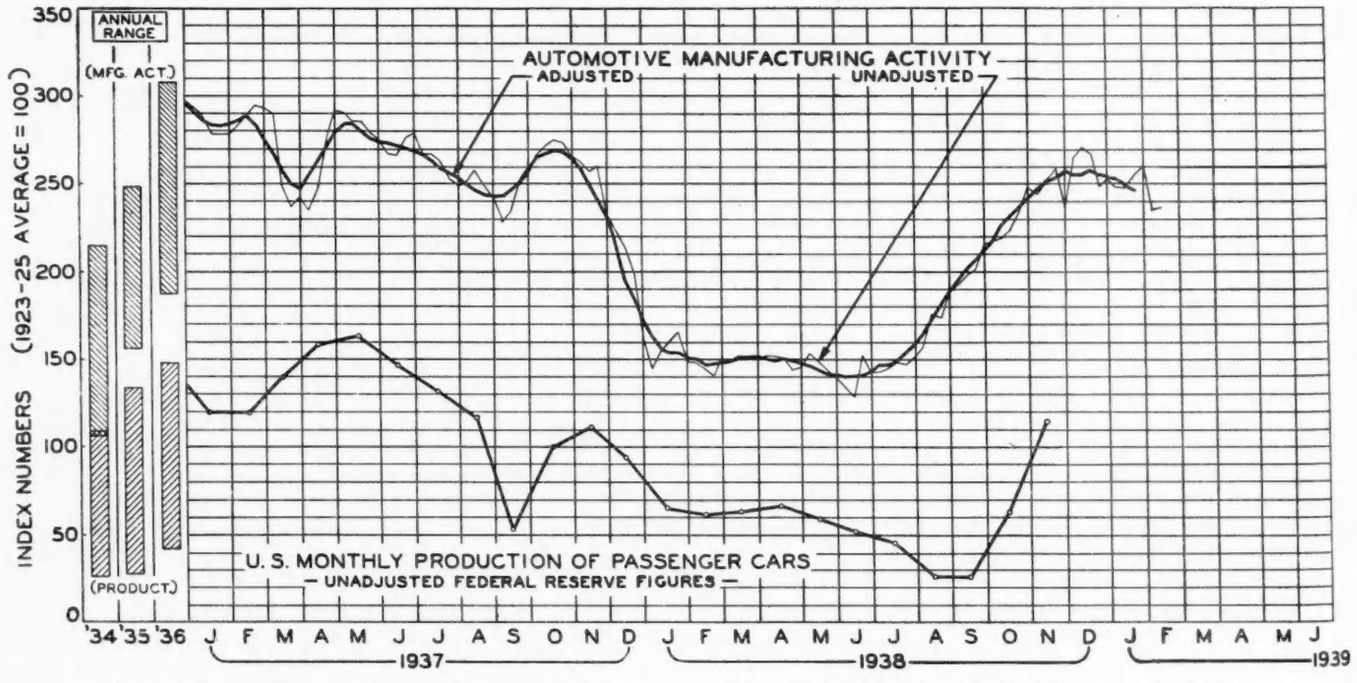
SIX PER CENT CASE. The FTC brief in the GM case has been filed. The respondents now have an opportunity to reply, after which final arguments will be scheduled. Final argument in the Ford proceeding is due to be scheduled soon.

Bright Nickel Now Under Udylite Corp.

All the capital stock of the Bright Nickel Corp., Detroit, owners of the basic Schlotter patents covering bright nickel plating process, has been acquired by the newly-formed Udylite Corp. Preceding the acquisition, the Udylite Co. formed a new organization to be known as the Udylite Corp., which has taken over all of the business and assets of the Udylite Co.

The Bright Nickel Corp. will be operated as a wholly owned subsidiary of the Udylite Corp. The personnel and policies of the Udylite Corp. will remain the same as those of the Udylite Co., which it supersedes and the same management will continue. Officers of the new corporation are as follows: Charles Awkermann, chairman of the board; L. K. Lindahl, president; C. H. Reeme, vice-president; and Horace Maynard, secretary.

Automotive Index Shows Slight Rise to 237



A slight increase in automotive activity for the week ending Feb. 11 brought the unadjusted index to the 237 mark—two points above the previous week, but 23 points below the week ending Jan. 28.

The adjusted index continued to move downward, the current posting being at the 247 mark—three points below the previous week. This down-trend has been apparent since the posting for Dec. 24.

Federal Announces New Light Trucks

The Federal Motor Truck Co., Detroit, has announced its entry into the low price light-duty field with two new models rated at ¾ ton. A choice of four or six cylinder engines is offered at $595 for standard wheelbase chassis at the factory.

One model is built with a four-cylinder, L-head engine of 3 3/16 in. bore and 4⅜ in. stroke, having a piston displacement of 139.6 cu. in. and developing 52 hp. The other model is offered with a six-cylinder, seven-bearing, L-head engine, 3¾ in. bore and 4⅛ in. stroke, 205 cu. in. displacement and developing 65 hp. Both engines are designed and built especially for truck service. Except for the difference in the engines, both models are identical in design and construction. They are built in four wheelbase lengths, 102, 111, 119, and 128 in.

40 Years Ago

In the motor vehicle, if anywhere, the noiseless gear is required, and here, also, if anywhere, cleanliness and durability are desiderata. All these qualities can be found in the rawhide gears and pinions manufactured by the New Process Rawhide Co., Syracuse, N. Y., whose goods have been before the mechanical world for a number of years, being successfully employed on electric motor cars, roller mills and geared machinery generally. The company have risen like the Phoenix, from the fire which recently destroyed their plant, and are again in a position to fill orders.

From *The Horseless Age*, February, 1899.

Plymouth Station Wagon

Plymouth division of the Chrysler Corp. has announced production under way on a new station wagon. The body is mounted on the Plymouth De Luxe passenger car chassis. With removable seats in place the station wagon provides accommodations for eight passengers and luggage.

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

(Week Ending Feb. 18)

BUSES Industry well ahead of last year to date. Indications that large municipal bus lines are interested in additional equipment livened producer's prospects this week. Several slight increases in production schedules reported.

TRUCKS Activity "just about the same." Large operators still reported to be the best buyers at present, with indications that spring may find orders ahead of deliveries. Several sizeable replacement orders noted this week.

TRACTORS Manufacturers still somewhat reluctant to express opinion for 1939. It is generally felt that production and sales are satisfactory in view of the general agricultural picture. Most factories working on production schedules to fill orders placed by dealers early in January.

AUTOMOBILES Seasonal decline in output now expected to be less than originally anticipated. AUTOMOTIVE INDUSTRIES' mid-week survey of factory schedules indicates an estimated production of 85,000 cars and trucks this week.

MARINE ENGINES Virtually no change in recent activity. One producer, inactive since 1924, this week announced its return with a line of light inboard engines.

AIRCRAFT ENGINES More and more aircraft engine parts makers reporting better business. Passage by House of Representatives of bill requesting 3,032 additional fighting planes for Army Air Corps portends stepped-up production schedules.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information, in all cases from official factory sources.

(Copyright 1939, Chilton Co., Inc.)

Election of Board and Trustee Clears Decks for Action at Reo

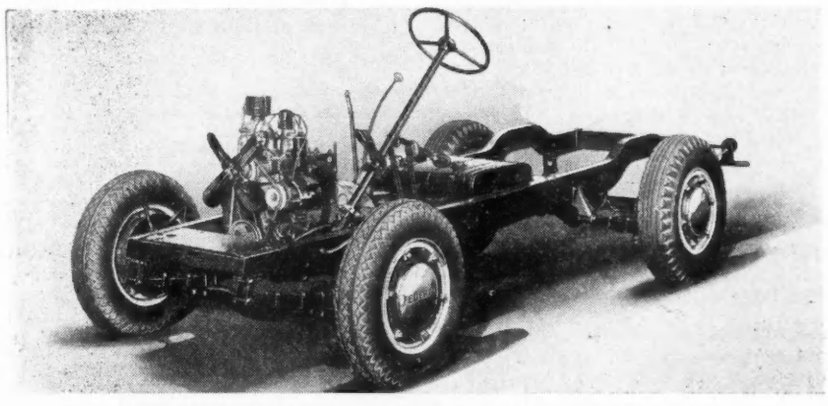
New Officials Pledge Complete Cooperation In Reorganization and Payment of Creditors

Election of an entirely new board of directors and appointment of a permanent trustee have cleared the decks for a prompt reorganization of the affairs of the Reo Motor Car Co. which was expected to enable the company to resume active business in the immediate future.

The new board and trustee were created by an agreement reached by all parties in the contest for control of the company who met in the U. S. District Court in Detroit during a hearing on a petition for reorganization under the Chandler Act. Their authority was recognized in a formal order issued by the court and was accompanied by a pledge by all parties of complete cooperation in working out a plan for prompt payment of creditors and such reorganization and changes in the corporation's capital structure as may be necessary to permit successful continuance of the business.

Theodore L. Fry, former treasurer of the state of Michigan, has accepted his appointment as permanent trustee and has already taken up his new duties in Lansing. He succeeded A. J. Brandt, temporary trustee, whose authority to serve in that position had been challenged by the Securities and Exchange Commission and several other interested groups. All other petitions bearing on the request for reorganization were either withdrawn or denied by the court to permit the new management to proceed unhampered in its duties.

The new directors are: Hugo Lundberg, president of the Lansing municipal light and power company; James Van Keuren, president of the Capital Building & Loan Co., Lansing; C. W. Otto, secretary of the Lansing Chamber of Commerce; Ray Potter, president of the Lansing National Bank; Otto Seyferth, Muskegon manufacturer; Ernest C. Smith, Lansing attorney; Ferris D. Stone, Detroit attorney; and Guy Hack, president of the Reo local of the UAW. One other director is to be named.



New ¾ Ton Federal Truck Chassis (See top of page)

Metal Markets Fear May Bill Leads to Uncertain Tin Prices

Report Betterment in Flat Rolled Steel Orders from Automotive Consumers

A sale of 80 tons of Grade A tin to the U. S. Navy Department at 45.27½ cents was followed by one of 75 tons to an automobile manufacturer at a price presumably near that figure. In the tin market it was said that the order of the automobile manufacturer had been placed at below the current cost of importation and was for early delivery. The Navy Department business went to the American agents for the Netherlands East Indies Government. From all of which it appears that consumers consider buying of tin at near the prevailing minimum price, which the international pool has set as its aim, without waiting for its being stepped up, as advantageous. The pool is following a somewhat more conservative course than was expected in some quarters. With a bill before Congress to permit the acquisition by the Government of strategic raw materials in which domestic production is inadequate, and the stocking of these against the possibility of the outbreak of war, the expectations of foreign tin producers might be much more ambitious than indicated by current quotations. The fly in the ointment is that the May bill, now before the House, provides for an expenditure of only $25,000,000 a year for four years of this stocking. At the present price of tin, a single ton entails an expenditure of around $1,000. There are many other metals and minerals besides tin, of which there is either no domestic supply at all or an insufficient volume, although tin is probably the most important. Obviously $25,000,000 a year would not go very far to build up anything like worth while stocks. Presumably this explains the lack of enthusiasm among foreign producers and marketers. Here the fear is expressed that liquidation of the stocks to be acquired under the May bill, might upset the market and that, in fact, by the simple device of throwing some of their holdings on the market or by withholding them, when they felt like it, Washington officials might keep the market periodically in a state of costly uncertainty. The tin market was rather slow getting under way following the holiday, Spot Straits was quoted on Tuesday at 45.40 cents, virtually unchanged from the preceding week's close.

A sharp increase in stocks of refined copper, both here and abroad, imparted a weak undertone to the metal. In the "outside" market spot electrolytic was offered at 10⅜ cents. The export price receded to 10.04 cents on Tuesday, but the quotation of producers and custom smelters remained unchanged at 11¼ cents. Automotive consumers are contributing a good share of the business that keeps Connecticut Valley brass mills operating at a relatively good rate. While the consumption of beryllium copper in automotive parts is still in the initial stage, it is interesting to note that one of the large beryllium interests plans important price reductions when a new recovery plant, now under construction, is ready for operations.

Mild betterment in the receipt of orders for flat rolled steels from automotive consumers was reported following the holiday. The American Iron and Steel Institute reported the rate of employed ingot capacity this week as 54.8 per cent, compared with 53.4 per cent last week. Most of this gain, however, was ascribed to better demand for rails and structural steel. Notwithstanding this, Detroit district steel mills, depending for virtually all their business on automobile manufacturers and parts makers, continue to operate at close to peak rates.—W. C. H.

GM-Cornell Index

The General Motors-Cornell World Price Index of 40 basic commodities for the week ended Feb. 4 was 60.9, compared with 60.8 for the previous week. The United States index in gold increased 0.1 point to 63.5.

The world index for the month of January, 1939, was 60.9, an increase of 0.3 point above the 29-year low for the preceding month. The preliminary January index in gold for the United States also increased 0.3 point.

Don Berlin Receives Achievement Award

Don R. Berlin, chief engineer of the Curtiss Aeroplane division of Curtiss-Wright Corp., was given the annual award of the Aero Club of Buffalo for "the most outstanding aeronautical achievement of the year." Mr. Berlin was the designer of the P-36 and the Hawk 75, high-powered pursuits. It was the Hawk-75 that took test pilot Lloyd Child on a reported record breaking power dive of 575 miles an hour over Buffalo Airport recently.

Crude Rubber Consumption Up

Consumption of crude rubber by manufacturers in the U. S. during the month of January, 1939, is estimated to be 46,234 long tons, which compares with 45,315 long tons during December, 1938. January consumption shows an increase of two per cent over December and is 57.1 per cent over January a year ago, according to statistics released by The Rubber Manufacturers Association, Inc. Consumption for January, 1938, was 29,429 long tons.

Imports of crude rubber for January were reported to be 39,082 long tons, an increase of 5.7 per cent over the December figure of 36,977 long tons, but 7.2 per cent under the 42,135 long tons imported in January, 1938.

The association estimates total domestic stocks of crude rubber on hand Jan. 31 at 237,826 long tons, which compares with Dec. 31 stocks of 245,413 long tons and 274,581 long tons on hand Jan. 31, 1938.

Rim Inspections

Rims inspected and approved by the Tire and Rim Association in January, 1939 more than doubled the number for January, 1938, according to a report by the association. There were 1,714,137 rims inspected in January, 1939 as compared to 527, 899 in the same month last year.

General Motors Overseas Sales

Sales of General Motors cars and trucks to dealers in the overseas markets during January, according to a report from the corporation, totaled 30,878 units, representing an increase of 3.4 per cent over sales in January of last year. These figures include the products of the corporation's American, Canadian, English and German factories sold outside of the United States and Canada.

Calendar

Conventions and Meetings

SAE National Aeronautic Meeting, Washington ..... March 16-17
American Foundrymen's Association, Forty-third Annual Convention, Cincinnati ..... May 15-18
SAE World Automotive Engineering Congress ..... May 22-June 8

Shows at Home and Abroad

Berlin, Germany, Automobile Show, Feb. 17-March 5
Sixteenth International Automobile Exhibition, Geneva, Switzerland, March 3-12
A.S.T.E. Machine and Tool Progress Exhibition, Convention Hall, Detroit ..... March 14-18
Yugoslavia, Belgrade, Automobile Salon ..... April 1-8
Great Britain, London, Automobile Show ..... Oct. 12-21
Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11
Great Britain, Glasgow, Scotch Automobile Show ..... Nov. 10-18
Italy, Milan, Automobile Salon, Oct. 25 to Nov. 11
International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6

Date Set for '39 Auto Show

A. M. A. Announces N.Y. Show for Oct. 15

The Show Committee of the Automobile Manufacturers Association announced on Tuesday that the 40th annual National Automobile Show will open at Grand Central Palace, New York, Oct. 15, with local dealer shows to open a week or, in some instances, two weeks later.

The date selected is three weeks earlier than last year, in order to meet the annual model announcements, and furnishes dealers with a longer fall selling period for used cars as well as for the new offerings in cars and trucks, it was stated.

A major consideration in the selection of this date, the A. M. A. said, was the contribution it will make for the stabilization of employment in both the automobile industry and its network of supplying industries. The employment necessary to manufacture dealer stocks and to satisfy new model customer demand thus is created in what would otherwise be the period of slack demand in the fall and early winter.

Byron C. Foy, chairman, Richard H. Grant and Paul G. Hoffman of the show committee, announce that the plans for this 40th anniversary affair will completely change the interior of the Palace along with the kind and character of exhibits.

There will be an exhibit of antique cars with suitable prizes for age, condition and past records, and an entire floor of 35,000 square feet for the only exhibit of delivery wagons and motor trucks that will be held in New York this year.

A.S.T.E. Program

Program for the annual national meeting of the American Society of Tool Engineers and the Machine and Tool Progress Exhibition, scheduled for Convention Hall in Detroit, March 14-18, is as follows:

Tuesday, March 14

9.00 A. M. Machine and Tool Progress Exhibition Opens . . . Convention Hall. Registration of members and vistors. Registration for Plant Inspection Tours.
9.30 A. M. Plant Inspection Tour.
1.30 P. M. Plant Inspection Tour. Exhibit close at 6.00 P. M.

Wednesday, March 15

9.00 A. M. Machine and Tool Progress Exhibition . . . Convention Hall.
9.30 A. M. Plant Inspection Tours.
1.30 P. M. Plant Inspection Tours.
8.00 P. M. **First Technical Session** Convention Hall Annex.
Subject: **"A Symposium On Mechanical Surface Finishing."** Chairman, C. J. Oxford, Chief Engineer, National Twist Drill Company. Introduction and General Discussion, J. R. Weaver, director of equipment, purchases, tests, and inspection, Westinghouse Electric and Manufacturing Co.

Aanhangwagenfabriek

In the past use of containers for handling freight on the railroads has suffered from a number of difficulties. Transfer of the heavy containers from trucks to freight cars and vice versa could be effected only at points where special loading equipment (a crane or derrick) was available, which made it necessary to switch the freight cars to such points. Moreover, both the consigner and the consignee had to have similar loading equipment in order to get the container onto and off the truck.

This problem apparently has been solved by Van Doorne's Aanhangwagenfabriek of Eindhoven, Holland, which has developed a special semi-trailer equipped with loading and unloading apparatus that is operated hydraulically by means of the tractor engine, through a power take-off on its transmission. The photograph herewith shows the loading equipment in operation. The container being loaded is that of the Netherlands Railways which has a capacity of 425 cu. ft. and will carry 5 tons.

Grinding—Ira Snader, chief Engineer, Ex-Cell-O; **Honing** — Kirk Connor, president, Micromatic Hone Co.; **Lapping**—H. J. Griffing, Norton Company; **Diamond Boring and Finishing**—F. T. Ellis, Heald Machine Co.; **Super Finishing**—D. A. Wallace, president, Chrysler division, Chrysler Corp.; **Measurements of Surface Finish**—Dr. Ernest Abbott, president, Physicists Research Co.
10.00 P. M. Exhibits closed for the day.

Thursday, March 16

9.00 A. M. Machine and Tool Progress Exhibition . . . Convention Hall.
9.30 A. M. Plant Inspection Tours.
10.00 A. M. Board of directors meeting, Fort Shelby Hotel.
1.30 P. M. Plant Inspection Tours.
6.30 P. M. **Annual Dinner,** Book-Cadillac Hotel.
Program: Report of National Officers. Installation of New National Officers. Details concerning speaker will be announced later.

Friday, March 17

9.00 A. M. Machine and Tool Progress Exhibition . . . Convention Hall.
9.30 A. M. Plant Inspection Tours.
10.00 A. M. Standards Committee Meeting, Fort Shelby Hotel.
1.30 P. M. Plant Inspection Tours.
8.00 P. M. **Second Technical Session.** Subject: **"New Developments and Their Effect on the Tool Engineer."** Chairman, Chris Borneman, supervisor, tool and gage department, General Electric Co.
Hydraulic Units—K. R. Herman, vice-president of Vickers, Inc.; **Gages**—C. Johnson of Pratt & Whitney Co.; **Cutting Tools**—L. C. Gorham, Gorham Tool Co.; **Gear Tooth Finishing**—R. Drummond, National Broach & Machine Co.; **Effect of Lapping or Honing of Cutting Edges of Tools**—John Lindegren, Crompton & Knowles Loom Works.
Exhibits open until 10.00 P. M.

Saturday, March 18

9.00 A. M. Machine and Tool Progress Exhibition . . . Convention Hall.
9.30 A. M. Tour of Greenfield Village.
6.00 P. M. Close of Machine and Tool Progress Exhibition.

Goodyear Earnings Under 1937 Mark

Consolidated net operating earnings of the Goodyear Tire & Rubber Co. for 1938 were $6,012,423, or $1,244,864 less than earnings reported for 1937, the company's annual report showed Feb. 13.

Consolidated net sales for 1938 fell off 23 per cent from 1937. Net sales for 1938 totaled $165,928,944, compared to $216,174,513 in 1937.

A deduction of $1,009,513 was in the 1938 earnings to reduce the value of current assets in foreign countries to reflect rates of exchange prevailing on Dec. 31.

Twin Engine Successful

The experimental plane built by Vega Airplane Co., an affiliate of Lockheed, and powered with two in-line Menasco motors, after exhaustive tests is said to have been entirely satisfactory. Menasco engines are mounted side by side in the new plane and drive a single propeller. The plane will operate at full load on either of the two engines, it is reported.

Bell Orders Tripled

Bell Aircraft Corp. of Buffalo reported unfilled orders of $3,675,000 compared with $1,200,000 at this time a year ago. Most of this is for the 13 Bell "Airacuda" fighting planes scheduled for delivery this year. Cost of new factory equipment installed last year was $100,000.

THE CHILTON ROUND TABLE

In order to give readers of AUTOMOTIVE INDUSTRIES a clue to certain merchandising and service aspects of the automotive industry which are normally outside the scope of an industrial publication, we present herewith excerpts from the February issues of the four other magazines published by the Automotive Division of the Chilton Co.

FROM MOTOR WORLD WHOLESALE

Surveys now show that car dealers average better than two used cars for every new car moved, which means that this year they will have to move more than 6,000,000 *used vehicles along with the new or a grand total of more than* 9,000,000 *cars and trucks.*

With an average allowance of $15 *per unit for reconditioning the used vehicles it looks like dealers will spend something like* $90,000,000 *in this end of their business alone.*

FROM AUTOMOBILE TRADE JOURNAL

That early introduction of new models affects attendance at automobile shows, scheduled many weeks after announcement, is generally recognized. Pennsylvania Automotive Association recently took the pulse of its dealer body on the subject and found that 70 *per cent of the* 750 *dealers who responded to a questionnaire favored a January announcement.*

FROM MOTOR AGE

Independent repair shops doing the greater part of their business within the boundaries of one State are exempted from the requirements of the Federal Wage-Hours Act, but if a movement now under way is successful, these local business men will not be free from wage and hours regulation very long. A strenuous effort is being made to have

(*Turn to page* 199, *please*)

Beryllium Alloys

By HARRY WILKIN PERRY

ONE of the latest of the rare metals to be put to use in the automotive industries is beryllium. First isolated 112 years ago, it is a steel-gray bivalent metal belonging to the magnesium group and has a specific gravity of 1.84, approximately the same as magnesium—nearly one-third lighter than aluminum. It melts at a high temperature—1350 deg. Cent., or 2462 deg. Fahr.—and in its pure state is too brittle at ordinary temperatures and too expensive (about $30 a pound) to be used as a structural material. It is not marketed in the pure state in the United States but is sold as a master alloy in copper, nickel and iron at market prices of the base metal plus $30 to $40 per pound of the contained beryllium, according to Louis L. Stott, of the Beryllium Corp. of Pennsylvania, in a paper presented at a meeting of the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers. Wrought beryllium-copper containing 1.75 to 2.25 per cent of the rare metal is offered in common commercial shapes and sizes at prices ranging from about 97 cents to $1.50 per pound.

Because of its light weight, hardness and pronounced effect on the heat-treatable characteristics of alloys, much hope has been entertained that beryllium might have properties like those of aluminum and magnesium or be useful as an addition to them. However, an investigation by the Beryllium Corp. of Pennsylvania of a wide series of beryllium-aluminum alloys containing more than 50 per cent of the former showed that, while some compositions can be cold rolled to a state of exceptionally high tensile strength, their ductility is low and their cost high. Research to date also indicates that beryllium does not alloy with magnesium, but that small additions to aluminum casting alloys may be useful for increasing resistance to wear, making them desirable for pistons.

Sand-cast test bars of a beryllium-aluminum alloy were made last year by the Materiel Branch of the Air Corps at Wright Field to ascertain its suitability for engine pistons. Reporting results in *Metals & Alloys* for April, 1938, J. B. Johnson, chief of the branch, gave the composition of the bars as: beryllium 67.43 per cent, aluminum 30.46 (by difference), manganese 0.93, iron 0.69, silicon 0.34, copper 0.12 and chromium 0.06 per cent. The physical properties were found to be as follows:

	Temperature	
	Room	500 deg. Fahr.
Specific gravity	2.05	
Tensile strength, lb./sq. in.	13,700	10,480
Yield strength, lb./sq. in.	13,600	....
Brinell hardness	75	57
Modulus of elasticity, lb./sq. in.	20,400,000	....
Thermal conductivity, cal./sq. cm./sec./deg. Cent	....	0.22

The tensile strength and Brinell hardness after heat treating were approximately equal to similar properties of forged 14 per cent silicon-aluminum alloy used in aircraft pistons but the conductivity was approximately only one-half, which would cause beryllium-aluminum pistons to operate at a higher temperature—a less favorable condition.

Writing in *The Metal Industry* for Jan. 7, 1938, E. R. Gadd, chief metallurgist, aeronautic engine department of the Bristol Aeroplane Co., Inc., England, says:

"The use of beryllium in light-alloy production remains to be developed, and no doubt future research will show means of using the attractive properties of beryllium. . . . It is the aircraft industry that has the most pressing need for new light alloys, and progress in this industry is very largely dependent upon their discovery and development."

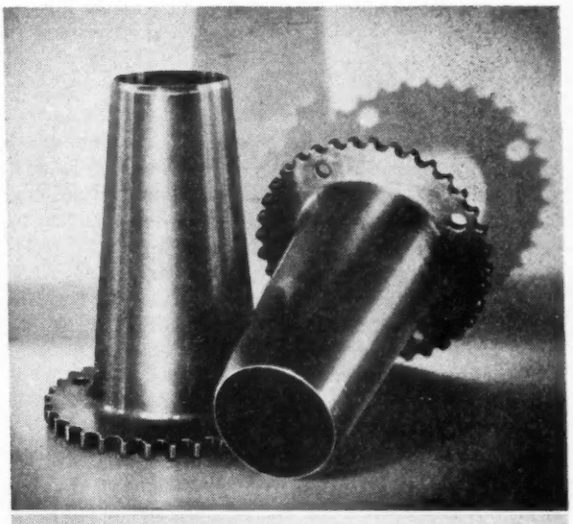
Automotive Materials 24

in Automotive Production

Employed as an alloy, beryllium has the very desirable properties of greatly improving the heat-treatable characteristics of the base metals for large increases in tensile strength, elastic limit, fluidity for casting, hardness, and resistance to fatigue, heat, wear and corrosion. Very small percentages added to copper result in dense, sound sand castings of high electrical conductivity and having sharp surface detail. Beryllium also has a remarkably strong affinity for oxygen and sulphur and is said to be more effective than calcium or lithium as a desulphurizing agent in a steel bath, as it is soluble in iron and has a high volatilization point. If even a surprisingly high content of the beryllium sulfide formed is allowed to remain in the melt, the steel can be hot rolled down to a thin sheet. Nickel also can be made rollable by small additions of beryllium without the use of magnesium and manganese. Investigators in Germany have reported that an addition of 0.02 per cent alone has made nickel 10 to 15 per cent softer than the best available commercial grades of pure nickel.

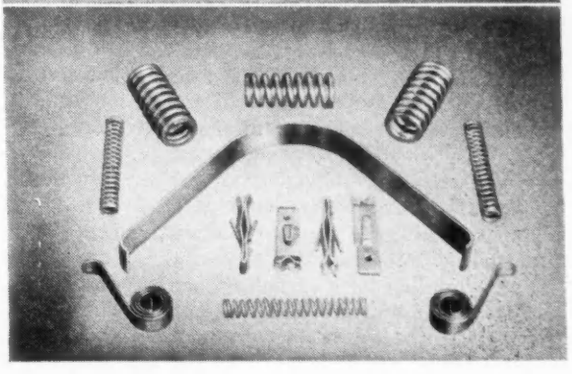
Beryllium-alloy applications in the automotive industries have been limited as yet mostly to small beryllium-copper contact clips and brushes in the electrical system, small leaf and helical springs and spring washers, diaphragms, precision bearings and bushings, small gears, and welding electrodes. As the alloys are relatively new, the specific uses to which they are being put are held confidential by the users in the motor vehicle and aircraft industries for competitive reasons and because of limited service experience with the metals and also, in the case of aircraft and aircraft-engine companies, because of secrecy imposed by the Army and the Navy. The most extensive applications to date have been in control instruments, electric switches and business machines.

One of the earliest American users of beryllium-copper was the Burgess Laboratories, which employs



Beryllium was used in the composition from which these adjustable-pitch propeller hub cones were cast.

This gear ring, also cast from a beryllium composition, is for the retractable landing gear of aircraft



Flat, coiled and helical springs and electrical plug clips shown by the American Brass Co.

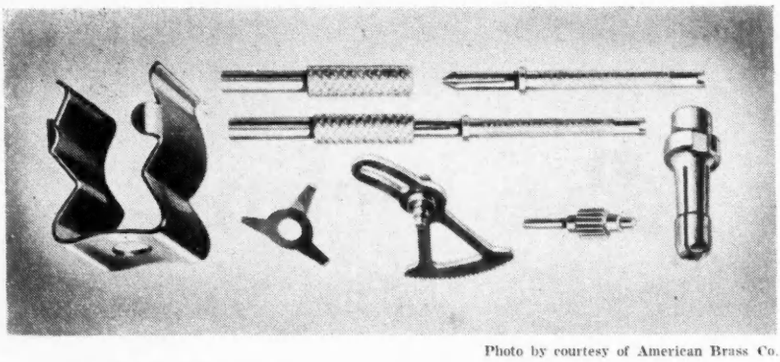


Photo by courtesy of American Brass Co.

Aerial camera parts, gage parts, railway jumper connector and fuse clip showing a diversity of parts made of beryllium alloys

it for contact-point spring purposes. In recent tests its Micro switch withstood 10,000,000 flexures with no detectable reduction in tension. The Chrysler Corporation employs from 2 to 2.5 per cent of beryllium in an alloy for making electric switch points. The composition contains very small quantities also of iron and nickel, the balance being copper. Beryllium-copper slow-break switches are used by the Hart Mfg. Co. to control the heater elements in its electric ranges because of the great fatigue resistance and high current capacity of the alloy. Exhaustive tests and three years of service have shown that these switches stand up far better than any other kind of heater switch in use.

The commercial sale of binary beryllium-copper alloys began in the United States about seven years ago and good progress in extending their uses has been made by the American Brass Co., Riverside Metal Co., Beryllium Corp. of Pennsylvania, Brush Beryllium Co., F. C. Hersee Co. and Belmont Smelting & Refining Works. Standard alloys produced by these fabricators contain from 1.75 to 2.25 per cent beryllium, and the Anaconda beryllium-copper of the American Brass Co. has from 0.25 to 0.50 per cent of nickel added to restrict grain growth and coarsening during the annealing process and usually contains less than 0.10 per cent iron, the rest being copper. They are now available in the forms of thick plates, sheets as thin as 0.02 in., strips, rods 5 in. or more in diameter, wires as fine as 0.01 in. in diameter, and tubes in common sizes up to 1¼ in. outside diameter. Experiments indicate that the alloy can be supplied also in the form of die-pressed forgings within certain manufacturing limitations.

Some applications of these forms, and the higher properties that make the metal superior to other non-ferrous alloys and to steel are: Switch blades, fuse clips and appliance-plug clips, because of fatigue and wear resistance and electrical conductivity; vibrator arms—fatigue resistance and conductivity; leaf and helical springs—modulus of elasticity, proportional limit, fatigue and corrosion resistance and conductivity; diaphragms and spring washers—spring properties, strength, fatigue and corrosion resistance; contact brushes—wear resistance and conductivity; precision bearings, bushings and ball cages—strength, stiffness, wear and corrosion resistance and machinability; bolts and screws — strength, corrosion resistance and machinability; and welding electrodes — hardness, strength and conductivity. A variety of products made of beryllium-copper are shown in accompanying pictures reproduced by courtesy of the American Brass Co.

The beryllium alloys have properties of value also for making castings, molds for plastics, and dies for metal forming and embossing. Heat-treated castings of 2.75 per cent beryllium-copper show a tensile strength as high as 150,000 lb./sq. in., compressive strength of 190,000 lb./sq. in., elastic limit of 135,000 lb./sq. in., and Rockwell C hardness of 40 to 42. Wire drawn from an alloy of 0.40 per cent beryllium, 2.6 per cent cobalt and 97 per cent copper, quenched at a temperature of about 1650 deg. Fahr. and tempered at 850 to 900 deg. Fahr. has shown a tensile strength of 137,000 lb./sq. in. and a conductivity of more than 50 per cent of that of copper. The alloy so treated possesses a combination of hardness, toughness, wear resistance and electrical conductivity and has been applied as resistance welding electrodes by the General Electric Co. with notable success for spot welding stainless steel, for flash and projection welding electrode parts and for certain types of seam-welding wheels.

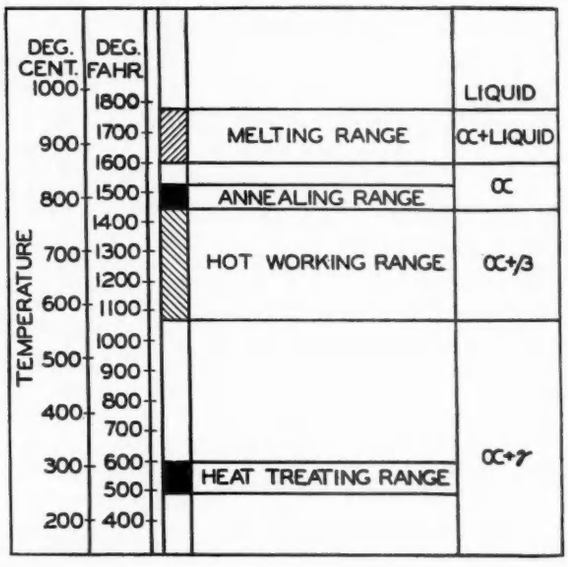
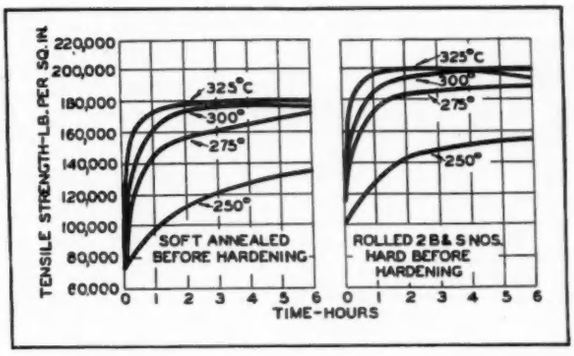


Chart showing the range of temperatures important in the fabrication and heat treatment of beryllium copper

An outstanding advantage of the beryllium alloys is that the mechanical properties can be varied over a wide range by suitable fabricating procedures. Articles can be formed from the metal in its softest state and then heat treated to make them two to three times as strong and much harder, more elastic and more resistant to fatigue than parts made of hard bronze or steel. Thus, soft

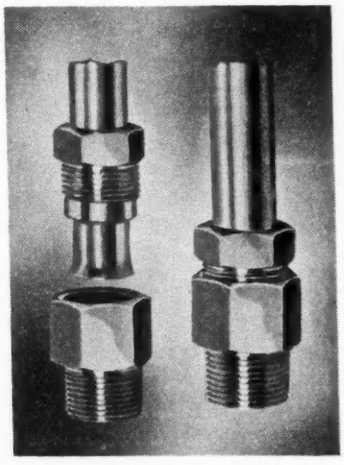
annealed beryllium-copper having a tensile strength of about 70,000 lb./sq. in. can be cold-worked and then heat treated to develop as high as 200,000 lb./sq. in. A 1.50 per cent beryllium-copper wire, partly cold-worked to get maximum conductivity, then given a precipitation treatment followed by more cold-working, has shown 190,000 lb./sq. in. tensile strength with 31 per cent electric conductivity and 177,000 lb. tensile strength with 35 per cent conductivity. Helical springs made of 2.25 per cent beryllium-copper and combining high elastic limit with relatively low torsional modulus can be static loaded to 100,000 lb./sq. in. without taking a permanent set and stressed to 40,000 lb./sq. in. in continuous flexion without showing fatigue, according to Louis L. Stott.



Strength of precipitation of hardened Anaconda beryllium copper

Beryllium - nickel and beryllium-nickel-chromium-iron alloys also can be heat treated to greatly increase their physical properties. One commercial type contains from 1.70 to 1.90 per cent beryllium and the rest nickel, and another 0.60 to 1.00 per cent beryllium, 7 molybdenum, 15 chromium, 0.60 nickel and the balance iron. The tensile strength of these can be more than doubled by quenching from the solid solution condition to the softest state, then cold-working and reheating at a moderate temperature. Ultimate strength has thus been increased from 115,000 lb./sq. in. in the soft state to 260,000 lb. by heat treating, hard rolling and reheating, and the Brinell hardness increased from 140 to 460 by the operations. Similar treatment of a beryllium-nickel-chromium-iron alloy resulted in increase of ultimate strength from 125,000 lb./sq. in. to 263,000 and Brinell hardness from 195 to 430.

The nickel-base alloys have unusual toughness and the beryllium-chromium-nickel-iron alloy is nonmagnetic and highly resistant to corrosion, hence is useful as spring material where high temperatures prevail, having been employed successfully in temperatures around 1000 deg. Fahr. Dr. W. Kroll, in a paper in *Metals & Alloys*, 1936, states that an alloy of iron, 1 per cent beryllium, 7 per cent nickel and 12 per cent chromium and no carbon can be hardened to 675 Brinell.



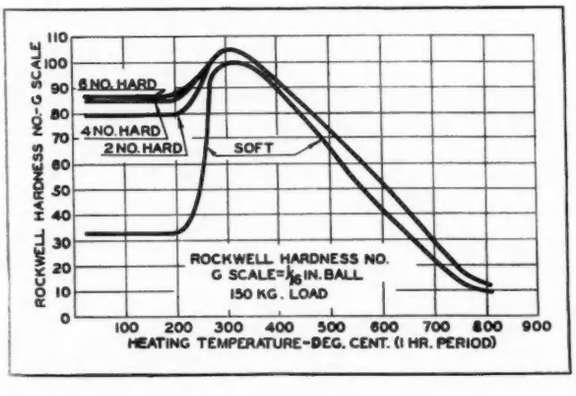
Oil and fuel line connectors has been found as another practical outlet for beryllium alloys

As a bearing material, beryllium-copper shows more than five times the wear resistance of bronze against steel, even without heat treatment. It seems to have a film-forming and self-lubricating property, but high rubbing speed combined with heavy load causes seizure between a 2.25 per cent heat-treated beryllium-copper bushing and a steel shaft. In dry rubbing tests under a load of 10 lb./sq. in. against a flat steel rotating disk the beryllium-copper specimens glazed quickly and wore evenly and only slightly, whereas bronze specimens under identical conditions wore more rapidly and less evenly.

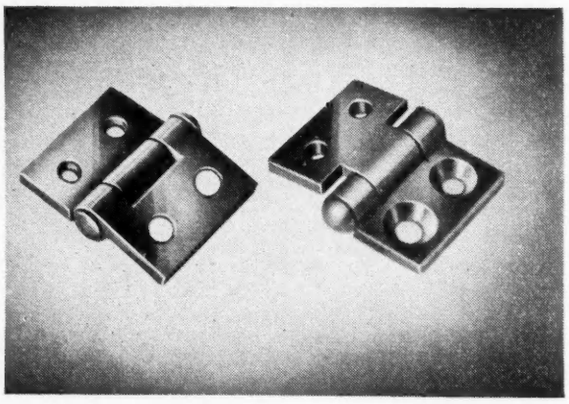
Resistance to fatigue, shock and wear are prominent characteristics of beryllium-copper. Laboratory tests have shown fatigue limits of 35,000 and 40,000 lb./sq. in. as compared with 25,000 and 27,000 for phosphor bronze. Charpy impact tests indicate that the alloy is in general tougher than plain carbon steel of corresponding impact resistance. As the moduli of elasticity are a little lower than those of steel, however, the gage of springs made of it should be increased slightly to obtain equal load-deflection characteristics.

Cold-working the fully annealed metal causes it to harden rapidly and it is necessary to anneal the work more frequently between workings than is the case with most copper alloys. It can be hot-worked at temperatures from 550 to 775 deg. Cent. by forging, pressing, upsetting, extruding, etc., but, as it cools fast, it is advisable to start work at the higher temperature to avoid reheating or to reduce the number of heats of parts requiring considerable forging. At forging temperatures the metal is more plastic than steel and therefore should be worked with numerous light blows rather than with a few heavy ones.

According to the fabricating directions of the American Brass Co., all material should be homogenized



Effect of one hour heating periods on the Rockwell hardness of Anaconda beryllium copper in several tempers given in B and S numbers reduction. Rockwell hardness G scale equals 1/16 in. ball, 150 kg. load

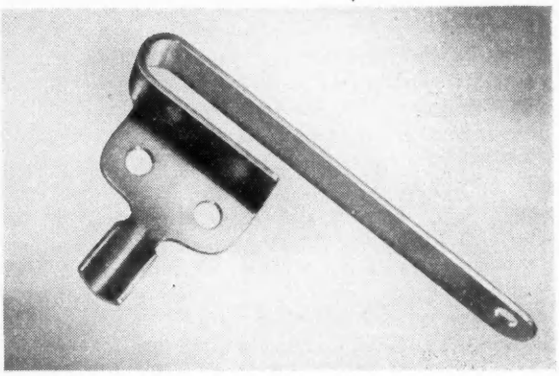


Here is a pair of hinges used on an airplane engine cowl cast in a beryllium alloy

by annealing when the metal becomes too hard for further work during a series of cold-working or forming operations, after brazing or welding, and after hot-working, before the product is precipitation hardened. To anneal between cold-working operations, the metal is heated to 800 deg. Cent. and held there for 15 to 30 min., then quenched immediately in cold water. This softens the metal. To anneal after hot-working, brazing or welding, it is held at 800 deg. Cent. for 3 hr. and quickly quenched in cold water. The purpose of this is to homogenize the duplex grain structure produced by hot-working.

Exposure to air for even a short time before quenching allows the surface to become somewhat oxidized and lose the bright appearance that can be produced by a hydrogen atmosphere in an electric furnace or oil or gas-fired furnace. Salt baths operated at the stated temperature cause corrosion of the metal.

Heat treating to strengthen and harden beryllium-copper products requires only heating to 250, 275 or 300 deg. Cent., holding there for a period of time depending upon the properties desired and the hardness of the cold-worked metal, then allowing it to cool gradually. The heating can be done in any muffle heated by electricity, gas or oil or in a molten salt bath so long as the temperature is accurately controlled. The exact temperature depends upon



This illustration of timer contact spring made of beryllium alloy is one and one-half times the actual size

Automotive Materials

Asbestos-Filled Molding Materials

Two newly formulated, asbestos-filled molding materials have been made commercially available by General Plastics, Inc., North Tonawanda, N. Y. These compounds are known as Durez 38-443 and Durez 38-646. Several advancements over others of their type previously offered have been incorporated into these new materials. Durez 38-443 was formulated specifically to meet underwriter's specifications of withstanding 200 deg. C. for 72 hr. It also has an impact strength of 0.25 (ASTM) and a compressive strength of 28,000 (ASTM). Heat resistance is recorded at 490 deg. Fahr. Specific gravity is 1.80.

Durez 38-646 has a very low specific gravity for asbestos-filled molding compounds—1.59. It has a slightly higher heat resistance, 500 deg. Fahr., but a lower impact strength—0.19 (ASTM). However, its flexural strength of 9000 (ASTM) is said to be greater than for any compounds of the type previously available. Compressive strength is also 28,000 (ASTM).

Hard Carbide Alloy for Machining Tough Metals

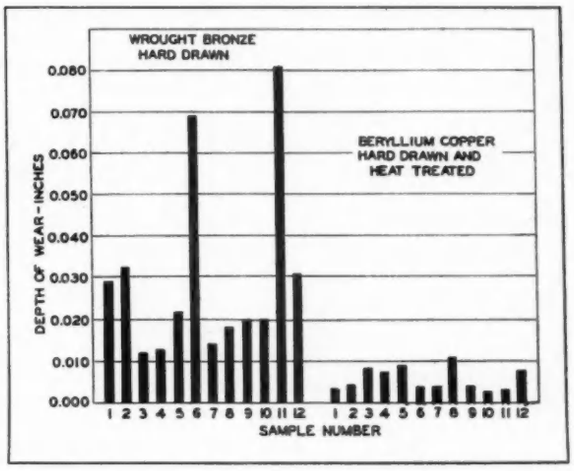
A new hard carbide alloy for roughing and finishing in one operation tough metals such as steel, heat-treated up to 500 Brinell, is being supplied under the trade name of "Kennametal" by the McKenna Metals Co., Latrobe, Pa. The alloy may be used also in machining such materials as monel metal, malleable iron, cast-iron, brass, bronze, and aluminum. Kennametal is said to permit two to six times greater cutting speeds than those of high-speed steel and 10 to 50 times as many pieces per grind of tool.

G.E. Improves Magnet Wire

Eliminating the need for space-consuming protective coatings in

the state of the material to be treated, as indicated by the accompanying chart for precipitation hardened beryllium-copper. The length of time for holding the material at the given temperature to obtain the desired strength and hardness ranges from 1½ to 5½ hr. Hardness and strength increase with length of heating up to a certain time and then decrease with longer heating until they become less than in the original metal. If ductility and fatigue resistance are desired, the heating period is preferably from 1½ to 2 hr.

Scale formed by forging, annealing or heat treating is removed by immersion for 3 to 5 min. in a warm pickling solution of two parts of commercial concentrated sulphuric acid and one part of water, or left for 5 or 6 hr. in a solution of one part acid to ten parts water, which is less dangerous to handle. From this bath the work should be given a quick immersion in a nitric-acid bright dip to remove the red copper film left on the surface, or immersed in a solution of 1½ to 2 lb. of sulphuric acid, 2 to 3 lb. of potassium bicarbonate and 1 cu. ft. of water. Pickling of finished articles is greatly facilitated if all oil, grease or soap is removed before annealing or heat treating.



Results of wear tests on beryllium copper compared with those on wrought bronze

Good joining of beryllium-copper can be done by soft soldering, silver soldering, brazing or electric welding. Soft soldering is done after heat treating and thorough cleaning. A 90 per cent tin, 10 per cent zinc solder makes a stronger joint than lead-tin solders. The parts being joined are kept as cool as possible to preserve their temper. When silver soldering, the work must be done with all parts at a temperature between 780 and 864 deg. Cent. and quenched from not less than the lower temperature. If it cools below that, it must be reheated for 30 min. at 780 deg. and then quenched to restore the metal to homogenized condition for hardening.

For electric welding with beryllium-copper or silicon-copper filler rod, no flux is used and the current is adjusted to produce a rapid melt without overheating the parts being joined. Backing the weld with steel to chill the weld metal quickly is recommended. Welds made with beryllium-copper rod, then peened and heat treated, have shown a tensile strength of 150,000 lb./sq. in.

NEW DEVELOPMENTS

many instances, Formex wire, the new magnet wire developed by General Electric is insulated with a synthetic resin said to be tougher and more flexible than conventional enamel coatings. The resin is of the polyvinyl acetal type.

Since present manufacturing facilities and the supply of polyvinyl acetal resin are restricted, there has not yet been extensive commercial application of the wire. These limitations are being corrected, and it is said that adequate supplies of the resin to produce Formex wire will soon be available.

Pre-Finish Treatment Of Zinc Surfaces

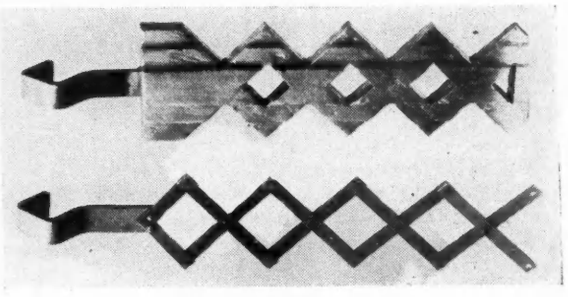
A different method for treating the surfaces of zinc, zinc-coated, and galvanized products before they are finished with lacquer, enamel, paint, or varnish has been developed by Maas & Waldstein Co., Newark, N. J. The new pre-treatment procedure entails dipping or wiping zinc or zinc-coated products with a solution of a compound trade-named "Zinsol." This results in the formation of an alloy consisting of zinc and another metal. Inasmuch as the alloy is chemically inert to moisture, the atmosphere, and organic finishes, it provides a stable foundation for any desired type of finish.

Rigid, Low-Resistance Lead Anode Announced

Securus Lead Products Co., Cleveland, has announced a new type of lead anode for chromium plating and other electrolytic processes. The advantages claimed are: low electrical resistance; even current distribution at all points of the active surface; and high mechanical rigidity against bending and warping.

The basic construction element is a lattice frame of strip copper. A thin film of pure lead is deposited and bonded to this frame and serves as an integrally homogeneous basis on which lead is built up to the desired thickness. Inasmuch as the lead is attached to the copper frame

by lead-burning or other suitable means, low resistance and rigidity are obtained. A final treatment with a lead-burning flame consolidates the lead coating to maximum density and assures freedom from porosity and blowholes which might otherwise permit penetration of the solution of the copper.



The construction element of the Securus anode is a lattice frame of strip copper to which the lead is bonded

New Hydraulic Brake Fluid

The Delco Brake division of General Motors Corp. has brought out a new chemically processed fluid for hydraulic brakes. Laboratory and road tests are reported to have demonstrated that the new fluid does not harm rubber or metal parts; has an extremely wide temperature range; does not cause "vapor lock" at temperatures even as high as 300 deg.; retains fully effective viscosity at 50 deg. below zero; and mixes readily with other brake fluids. It is called Delco Super 9 hydraulic brake fluid.

Cleaner for Removing Stains from Metals

A new metal cleaner that removes stains and oxides from copper, brass, bronze and other metals, except aluminum, iron and zinc, has been announced by Rapid Electroplating Process, Inc., Chicago. The product is marketed as "1-Second" Cleaner and is said to contain no abrasives. It cleans by chemical action only and requires no rubbing. "1-Second" Cleaner has a jelly-like consistency and is applied with a brush.

Temperature-Sensitive Colors

REFERENCE has been made in these columns repeatedly to paints which change their color at certain definite temperatures and, therefore, can be used for (rough) temperature measurements. At one time, for instance, it was proposed to use such temperature-sensitive colors for the purpose of indicating engine temperatures, but the proposal never found practical application. The salts most frequently used in the past were double salts such as mercury and silver iodide which at 113 deg. Fahr., changes from yellow to orange, and mercury and copper iodide, which at 158 deg. changes from red to black. One difficulty with these colors was that on cooling they returned to their original color, so that they could not well be applied to temperature determinations on parts which are hidden from view during operation.

The I. G. Farbenindustrie A. G. in its Oppau research laboratory now has developed a series of paints which change their colors at definite temperatures and for which it it claimed that the colors are fast and do not change on cooling; that there are clear color differences, and that the changeover from one color to another is quite sharp. These paints, which are to be marketed under the name Thermocolor, consist of metallic salts which at definite temperatures give off water, carbon dioxide, or ammonia, and at the same time change their color. Some 300 compounds were investigated, and those which were found practical for this purpose are listed in the following table:

Thermo-color No.	Color Change	Temp. (Deg. Fahr.)
1	Rose to blue	86
2	Light-green to blue	140
3	Yellow to violet	230
4	Purple to blue	284
5	White to greenish-brown	347
6	Green to dark-brown	428
7	Yellow to reddish-brown	554
8	White to light brown	644
9	Violet to white	824
20	Light rose to light blue	149
	Light blue to light brown	293
30	Light green to light blue	149
	Light blue to olive green	293
	Olive green to gray brown	428
31	Brown to gray brown	311
	Gray brown to green brown	446
	Green brown to rust-brown	527

The binder, a synthetic resin, is mixed with the powdered color in a finely divided state, so that it is only necessary to stir with alcohol to produce a paint that can be applied either by hand or by means of a spray gun. The coating is not attacked by either oil or gasoline, and it adheres firmly at high temperatures which destroy the synthetic binder.

One difficulty with the thermocolors for low temperatures is that the temperature change reverses slowly under the influence of atmospheric humidity and rapidly when the surface is wetted. For that reason work is being carried on with a view to developing low-temperature colors free from this defect.—*ATZ*, Jan. 25.

Hydrogenation Activities in France

NOTWITHSTANDING the high cost of gasoline production by the hydrogenation process, France is proceeding with the installation of plants for the production of aviation grade gasoline by this process. For the past three years processes based on the Bergius principle have been worked experimentally at Bethune and Lievin, by coal companies located at these points. The original Bergius process is said to have been improved by F. Vallette, chief engineer of the Bethune Coal Company, and E. Audibert. The development work so far has been

(Turn to page 199, please)

Just Among Ourselves

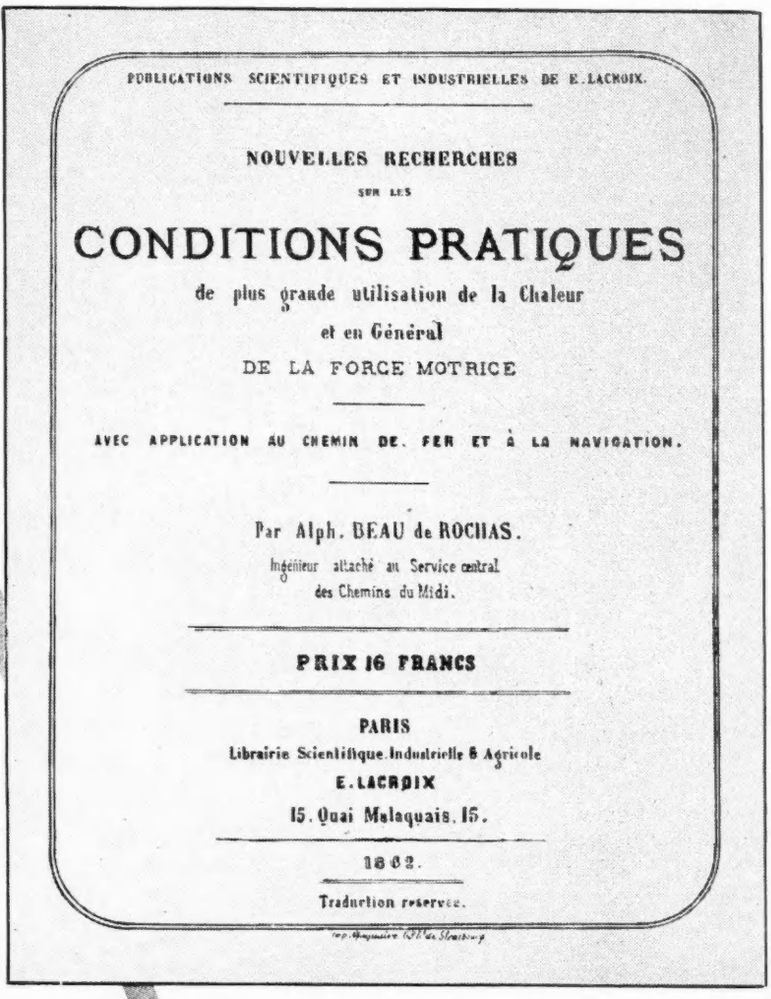
The Ides of October

THE Automobile Manufacturers Association has announced that the 1939 National Automobile Show will open in New York on Oct. 15. This announcement can be expected to be received as a cold and unwelcome shock by a large section of the automobile dealer body, which has been encouraged by recent events to expect some relief from merchandisers migraine. A recurrent symptom of the latter disease has been the local automobile show; usually an expensive and troublesome buildup for the anticlimax which comes from the fact that everyone has seen the new models anyhow by the time they are fanfared in the foothills.

The Automobile Manufacturers Association has its troubles too. One of them is trying to set a show date that will be satisfactory to its members, and will also allow some of the cars shown to be less than sixty days old when the show curtain is pulled aside.

We predict that an Oct. 15 national show date will result in a further diminution of the number of local automobile shows held throughout the country. If such a condition is to be faced with equanimity, we have no quarrel with the date. On the other hand, it's a relatively long time until Oct. 15, and a compromise might be arranged.—HERBERT HOSKING.

In 1862 Beau de Rochas issued a pamphlet in which he for the first time recorded his principle of the four-cycle engine. Here is shown the first page or cover.



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AVEC APPLICATION AU CHEMIN DE FER ET À LA NAVIGATION.

Par Alph. BEAU de ROCHAS.

Ingénieur attaché au Service central
des Chemins du Midi.

PRIX 16 FRANCS

PARIS

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E. LACROIX

15, Quai Malaquais, 15.

1862.

Traduction réservée.

By P. M. Heldt

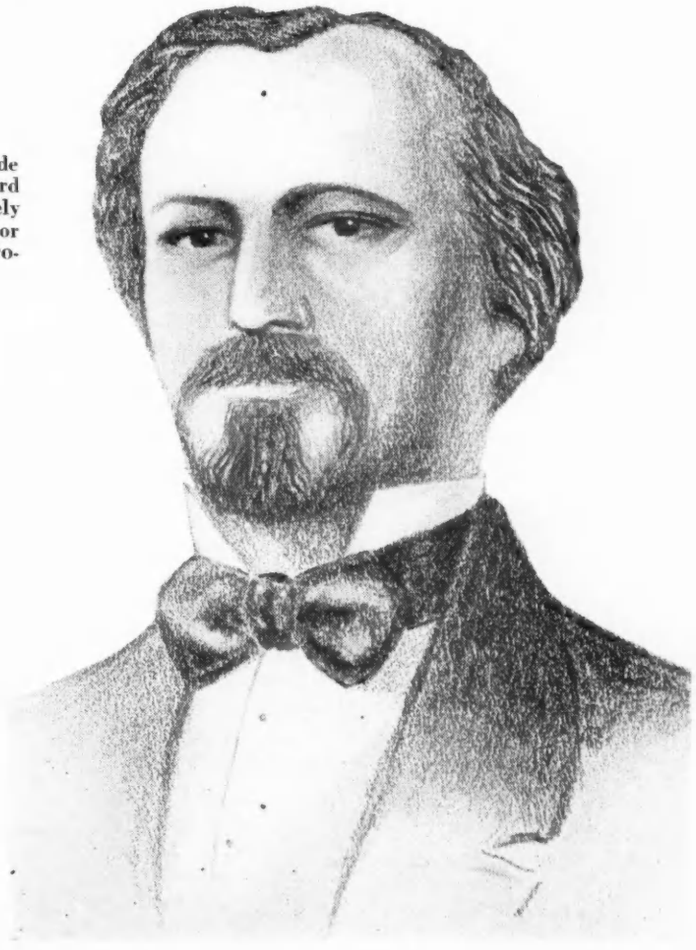
INTEREST in the origin of the four-stroke cycle for internal combustion engines was revived abroad a little more than a year ago when the French Society of Automobile Engineers, in collaboration with other French scientific and industrial organizations, unveiled a bronze tablet to Alphonse Beau de Rochas, French railroad engineer, who is credited with the invention of that cycle. In textbooks and in the periodical press outside of France it is generally known as the Otto cycle, and the circumstances surrounding the conception of the cycle and which led to its being named after some one else than its original inventor, make an interesting chapter of internal-combustion-engine history.

During the early sixties of the past century there was considerable activity in Europe, and particularly in France, in connection with the development of heat engines in which air served as the working medium, instead of steam. The fuel which was used for these early combustion engines was coal gas or town gas, which had come into use for lighting in the large cities a few decades earlier. Scientists specializing in the new branch of science known as thermodynamics had come to the conclusion that air was a better working medium for a heat engine than water, because with air it is not necessary to supply any latent heat of vaporization, which cannot be recovered in an engine. Carnot had formulated his cycle for combustion engines, which (theoretically at least) assures the maximum useful work for operation between definite maximum and minimum temperatures. A number of gas engines had been patented, but only one, that of Lenoir, had reached the stage of commercial production. In the Lenoir engine, a mixture of air and coal gas was drawn into the cylinder during the first half or so of the "in" stroke; then the inlet valve was closed, the charge at atmospheric pressure (or very close to it) was ignited by an electric spark, and during the remainder of the "in" stroke the charge, whose pressure was raised to four or five atmospheres by the combustion, was expanded and generated mechanical power. The return stroke was the exhaust stroke.

From the fact that in the Lenoir engine the charge when fired by the spark was at the same density as it is in a modern engine shortly after the exhaust has opened, it can be readily imagined that it was impossible to get any great amount of power from an engine of given displacement, and that the efficiency was low. That the specific output was

Origin of the Four-Stroke Cycle

Recognition of Alphonse Beau de Rochas has created considerable interest in the history of the development of the internal combustion engine. A tablet is to be placed in the Conservatory of Arts and Crafts in Paris in honor of him. The foreign correspondents of AUTOMOTIVE INDUSTRIES, *W. F. Bradley in France and Edwin P. A. Heinze in Germany, in collaboration with the author, have gone to great pains to obtain for this article authentic illustrations and data. Here, therefore, is the historic background surrounding the—*



Sketch of Alphonse Beau de Rochas reconstructed by Howard Kohlbrenner from an extremely rare picture of the inventor found in the library of AUTOMOTIVE INDUSTRIES.

low was of minor importance, because during the middle of the nineteenth century the tempo of life was slower than it is today, and not so much power was required. But the high fuel consumption was a more serious drawback. The gas engine was a competitor of the steam engine and on the heat-unit basis the cost of gas was considerably higher than that of coal, the fuel used for raising steam. Hence, in order to compete successfully, it was not sufficient that the thermal efficiency of the gas engine equal that of the steam engine; it must be sufficiently higher to overcome the differential between the costs of the two fuels on the basis of heat content.

When the Lenoir engine was first introduced it was hailed as an important advance in the field of power generation, and the simplification due to the absence of a boiler was in its favor, but its performance from the standpoint of fuel consumption proved very disappointing. In one test made on a small engine the consumption ran as high as 122 cu. ft. of Paris city gas per horsepower-hour, and few of the test results re-

corded show consumptions of less than 100 cu. ft. per hp-hr. This made the cost of operation prohibitive, and after the first enthusiasm had subsided sales of the engine dwindled rapidly.

What was necessary to increase the thermal efficiency and decrease the fuel consumption was to compress the charge before igniting it. The advantages of compression had been recognized quite early, and an engine in which the mixture was forced into the working cylinder under pressure was patented in England by William Barnett as far back as 1838. Compression was proposed also by several other inventors, but at that time a great many other problems besides that of the cycle of operation remained to be solved, and none of these engines came into practical use.

Beau de Rochas, who had been a railroad engineer connected with the Southern Railroad of France, in 1862 issued a 53-page pamphlet in manuscript form under the title "Complete Description of Some Improvements in Steam Boilers and Gas Generators." De Rochas evidently had a good knowledge of the railroad powerplants of his day, and of their shortcomings; he was a thinker, and in his pamphlet he proposed numerous modifications to overcome operating difficulties and to reduce the fuel consumption. The cover of De Rochas pamphlet and one of its pages are reproduced herewith in facsimile. It is reported that 300 copies of the pamphlet were produced, apparently from line engravings.

The pamphlet dealt particularly with four types of apparatus, viz., steam boilers, gas generators, a "mixed" or combination steam-gas engine, and small power units. It will be gathered from the foregoing that the pamphlet covered considerable ground. It was in the description of his "mixed" or combination steam-gas engine that Beau de Rochas gave a clear outline of the four-stroke cycle. While precompression had been used before in gas engines, or at least had been proposed by inventors, it had always been accomplished in compressor cylinders separate from the working cylinder. The outstanding feature of de Rochas' scheme was that only a single cylinder should be used, for the compression of the gaseous charge, for its expansion after ignition, and for the expansion of steam used in the same cylinder, at the opposite end thereof. The engine therefore was to be a double-acting one, like all steam engines in use at that time.

Among the advantages de Rochas hoped to gain by using both steam and gaseous mixtures in the same cylinder were that the engine could be started by steam and that the heating of the cylinder walls by the gaseous explosion would tend to superheat the steam and thus eliminate the losses due to condensation, which were so serious in the early steam engines.

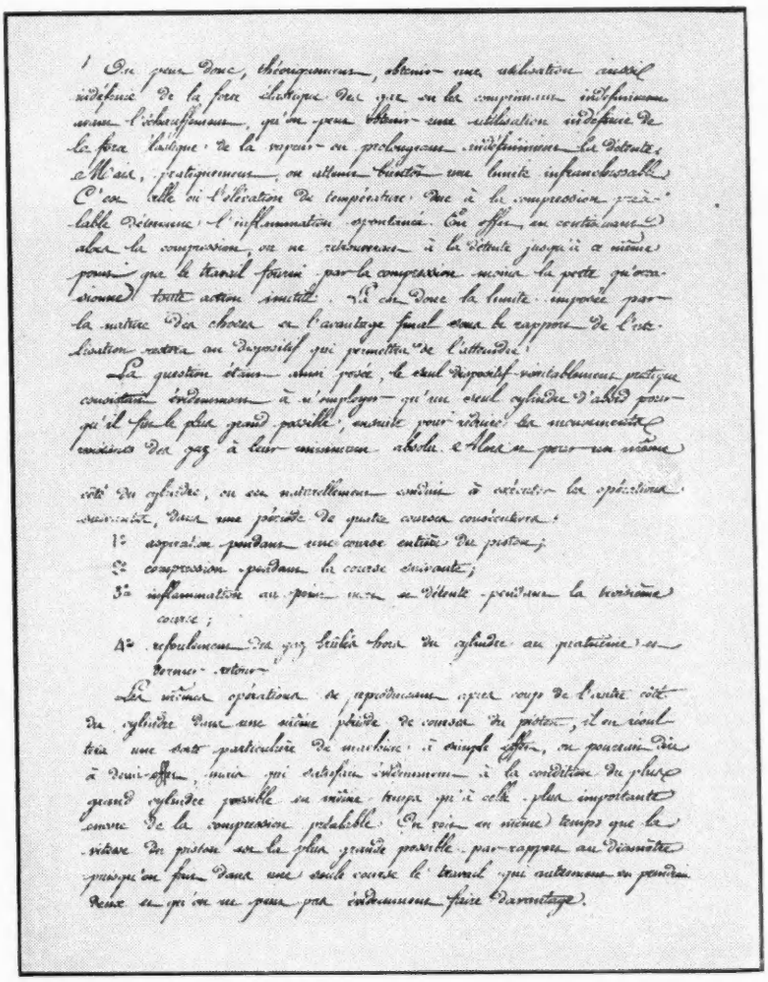
Beau de Rochas explained that four conditions were essential to an increase in the efficiency of gas engines, these being as follows:

1. Use of cylinders of the largest volume combined with the smallest surface area.
2. Maximum piston speed.
3. Maximum expansion of the gases.
4. Maximum pressure at the beginning of expansion.

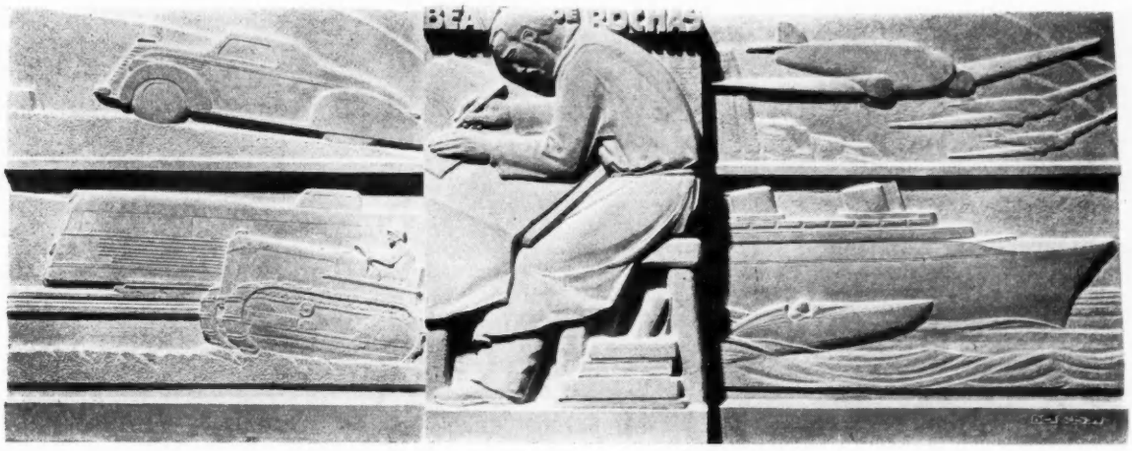
Continuing his explantions Beau de Rochas said:

"The characteristic of gases to expand over a given area can be turned to excellent account in pipes, but is an obstacle to the utilization of the elastic force developed in the gaseous mass. It has been shown that in pipes the utilization—that is, the heat transmitted—is in proportion to the diameter of the pipe. In cylinders, therefore, the loss would be in inverse ratio to the diameter, but this applies only to cylinders of very small diameter, and the loss really diminishes more rapidly in proportion to the increase in diameter. Thus the typical design, which for a given consumption of gas provides a cylinder of the largest diameter, will in this respect utilize the most heat. We may also conclude that, as far as possible, only one gas cylinder should be used in any one engine.

"But the loss of heat in the gas depends also on the time. Other things being equal, the cooling will



Here is the original manuscript of de Rochas in which he describes the principle of the four-stroke-cycle



This tablet has been dedicated by the Societe des Ingenieurs de l'Automobile of France in honor of Beau de Rochas

be greater the lower the speed. Now, greater speed seems to imply a cylinder of small volume; but this apparent contradiction vanishes if we remember that for a given consumption of gas the stroke is not necessarily and invariably limited to the volume of the cylinder.

"In making use of the elastic force of the gas it is necessary, the same as with steam, that expansion should be increased as much as possible. In the typical design described above, there is a maximum expansion for each particular case, although the performance is necessarily limited. That arrangement, therefore, will give the best result which endows the engine with what may be called its 'liberty of expansion,' that is, gives it the power to expand as much as may be thought desirable, within practical working limits.

"Lastly, utilization of the elastic force of the gas depends upon a function closely connected with prolonged expansion and its advantages. This is the pressure, which should be as great as possible, to produce the maximum work. Here the problem obviously is to expand the gases while they are hot, after compressing them while they are cold. This is to a certain extent an inverse method of prolonging expansion, compared with that employed when a vacuum is formed. The latter process is not at all suited to gases, because all such compression necessitates an equivalent condensation, and even supposing the gases were combustible, it would be impossible to heat them instantaneously.

"Theoretically, therefore, it is possible to utilize the elastic force of the gases without limit, by compressing them indefinitely before heating, just as the elastic force of steam may be utilized without limit by prolonging expansion indefinitely. Practically a definite limit is reached as soon as the temperature rise due to the compression causes self-ignition. If compression be continued further, the work done would be represented by expansion prolonged to the same point, less the loss caused by all useless work. The natural limit is here reached, and the arrangement which attains it utilizes the heat supplied most efficiently.

"The problem of heat utilization being thus stated, the only really practical arrangement is to use a single cylinder, first in order that the volume may be as large as possible, and next to reduce the resistance encountered by the gas to its absolute minimum. Therefore, for one end of the cylinder, one is naturally led to perform the following operations during the period of four consecutive strokes:

"1. Aspiration of the charge during an entire piston stroke;

"2. Compression during the following stroke;

"3. Ignition in dead center and expansion during the third stroke;

"4. Expulsion of the gas from the cylinder during the fourth and last stroke.

"The same operations are repeated at the other end of the cylinder, during the same number of piston strokes, the result being a special kind of simple-acting, or one might say half-acting engine, which evidently satisfies the condition of the largest possible cylinder, and at the same time, what is still more important, works with pre-compression. It will also be seen that the piston speed is the maximum possible, with respect to its diameter, as one accomplishes in a single stroke the work which would otherwise be done in two, and it would evidently be impossible to do more.

"As the temperature of the gases issuing from a generator is practically constant, and that of the outside atmosphere varies only little, relatively, the initial temperature of the mixture upon entering the cylinder also will be practically constant. It will therefore be possible to determine the limit of compression at which self-ignition takes place, and to design the engine accordingly. Thus the maximum performance will always be obtained for each particular mixture ratio. At the same time there will be no need to use electricity, because starting of the engine being effected by steam, the gases might be admitted only when the speed was great enough to produce spontaneous ignition. In any case, compression, by assisting in thoroughly mixing the charge, and raising its temperature, would favor spontaneous combustion. If the initial temperature in the generator corresponded to a pressure of 5 or 6 atmospheres, ignition would occur spontaneously if the gases were compressed to about one-quarter of the original volume, the loss of heat being neglected. After complete ignition, the pressure would be hardly 30 atmospheres, and as the combustion would be effected without excess air, in any other case, that is, with excess air, the pressure would be less. Probably, therefore, in many cases the absolute limit of utilization of the heat would be achieved.

"We may sum up the question by saying that, although the typical arrangement here described can be

most completely and perfectly adapted to the utilization of the elastic force developed by combustion, at constant volume in the gaseous mass, it is quite simple. It is perhaps rather a convenience than a necessity to use poppet-valve distribution. This is generally the best method, and nothing proves that it may not be applied to the four-cycle type of engine."

Considering that the foregoing was written more than three-fourths of a century ago, the reasoning for the most part is remarkably logical, though some of the expressions used are rather quaint. It is noteworthy that Beau de Rochas was in favor of the use of poppet valves at a time when all gas engines were equipped with the familiar D-shaped slide valves of steam engines. About the only wrong conclusion arrived at by the author is that he could do away with electricity for ignition by using compression ignition, which cannot be used successfully in engines in which the fuel is introduced with the air.

In 1876 Dr. N. A. Otto of Cologne, Germany built the first serviceable four-cycle engine

The action of the French Society of Automobile Engineers in placing a tablet to the memory of Beau de Rochas was taken at the instigation of one of its members, M. A. Labarthe, who is connected with the faculty of the University of Paris. M. Labarthe in an address, in which he eulogized de Rochas for his achievements, stated that the latter took out a French patent covering the four-sroke cycle on Jan. 16, 1862. This statement is contradicted in an article in the German *Automobiltechnische Zeitschrift* by Jul. Küster, patent attorney, who made a search of historical material relating to the origin of the four-stroke cycle with the assistance of the German Museum in Munich and the Association of German Automobile Manufacturers. Küster states that a search of the French patent records from 1861 to 1869 inclusive fails to show a patent granted to Beau de Rochas under this classification. He points out, however, that according to Aime Witz, an early French writer on thermodynamics and gas engines, Beau de Rochas applied for a patent in 1862 but allowed his application to lapse by failing to pay the dues, and the patent, consequently, was never published.

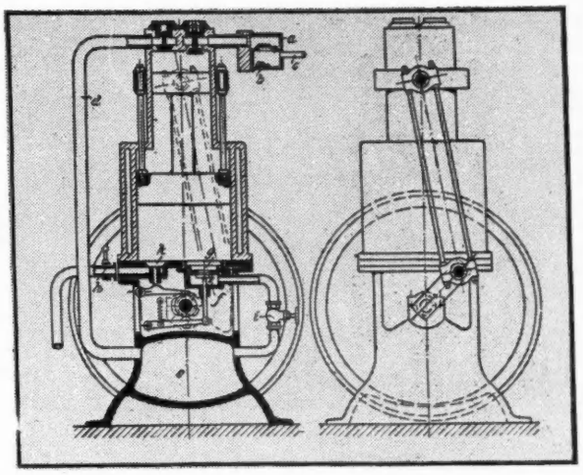
Publication of this pamphlet by Beau de Rochas had no immediate effect on practice in gas engine design, either in France or abroad. It was brought prominently to the attention of the gas-engine industry only more than twenty years later, in connection with litigation started to nullify the Otto patent in Germany.

Dr. N. A. Otto of Cologne, Germany, who had been in business building atmospheric gas engines for more than a decade, in 1876 brought out what was known as the "new Otto engine," which operated on the four-stroke cycle and had other improved features which greatly increased its efficiency over previous types of gas engine. An early example of the new Otto engine tested under the direction of Professor Thurston at Cornell University showed a fuel consumption of only 24.5 cu. ft. of gas per indicated hp-hr., or only about one-third that of atmospheric engines. The engine was protected in Germany by Patent No. 532, issued shortly after the new patent system of the German Empire went into force on July 1, 1877. It covered various features of the new engine, one of these being the four-stroke cycle; another, stratification of the charge inducted, to which great virtues were ascribed, and a third, ignition by means of a Bunsen burner, from which flame was communicated to the charge inside the cylinder through the intermediary of a small charge of combustible mixture in a pocket in a slide valve.

Owing to the much higher efficiency of the Otto engine, other manufacturers still offering atmospheric engines were unable to sell them, and attacks against the Otto patent were launched at once. Under the German patent system, applications for patent are made public and interested parties are granted a certain time in which to file objections to the granting of the patent. No less than six different petitions praying for the nullification of the Otto patent were filed. In the first trial, which ended in 1884, the opposition succeeded in securing a narrowing of the first claim of the patent, and in the second trial, in 1886, some of the claims were voided, including that covering the four-stroke cycle.

Apparently the de Rochas' publication describing the four-stroke cycle was first mentioned in this connection in correspondence which appeared in the *Zeitscrift des Vereines Deutscher Ingenieure* in 1883. During that year Paul Wiegand in Hannover published a pamphlet entitled "On the Question of Free Competition in the Gas-Engine Industry." Objections to some of the contents of this publication were made in a communication to the *Zeitschrift* by Professor Schoettler, who later in the second trial acted as expert for the Patent Office. In his reply, in the *Zeitschrift des Vereines Deutscher Ingenieure* of Jan. 12, 1884, Wiegand mentioned a number of alleged anticipations and ended by quoting two paragraphs from Beau de Rochas' pamphlet.

Another document bearing on the early history of the gas engine is a reprint of an address by Dr. Arnold Langen delivered before the Cologne Branch of the Society of German Engineers at a meeting held in 1936 to commemorate the sixtieth anniversary of the production of the first practical four-stroke engine. Dr. Langen mentions that in 1873 (that is, three years before the advent of the first practical four-stroke engine), the American subsidiary of the Deutz Gas Engine Works reported the appearance of a small serviceable gas engine in the United States. Langen (Otto's partner in the Gas Engine Works) arranged for the purchase of a sample engine. As related later by Maybach, who had joined the Gas Engine Works in 1872, upon its arrival the engine was studied by Otto very carefully.



The Brayton engine, of American design, operated on a two-stroke cycle

This Brayton engine (see drawing) operated on the two-stroke cycle, with pre-compression of the air-gas mixture in a separate cylinder. The mixture was forced under a pressure of 5 to 6 atmospheres into an intermediate chamber, whence it passed into the working cylinder through an inlet valve. To prevent back-firing, layers of fine-mesh wire screen were inserted between the valve and the interior of the cylinder. The inlet valve was purposely made so it did not close tight. This made it possible for a small flame to keep burning back of the wire screen even during the exhaust stroke. During the inlet stroke the flame was enlarged by the increasing flow of mixture. In the working cylinder, therefore, the action was similar to that in a compressed-air engine, the air charge virtually being increased by the combustion. The ignition flame was never to be extinguished as long as the engine remained in operation. "The machine," states Dr. Langen, "is said to have been quite operable, although it had serious weaknesses. To judge from test reports at hand, its thermal efficiency must have been below 8 per cent." For Otto this engine was a very instructive model. The chief weaknesses of the machine were that in case of any irregularity in the gas supply the ignition flame would become extinguished, and that sometimes the flame would light back through the wire screen and ignite the mixture in the intermediate chamber.

It may be recalled in this connection that it was a Brayton engine which was shown in the drawings of the Selden patent.

The claim of Beau de Rochas to the invention of the four-stroke cycle received further support and further publicity by the inclusion, in facsimile, of a number of pages from his 1862 pamphlet in the book by Hugo Güldner on the Design and Calculation of Internal-Combustion Engines, which ranks as a classic of gas-engine literature, and of which an English translation by the late Professor Diederichs of Cornell University was published in this country.

Beau de Rochas seems to have been the type of individual often described as "dreamers," as contrasted with the type classified as "men of action." That he was a highly intelligent man there is ample evidence. From the sketch given of him by Professor Labarthe it appears that he lived in dire poverty nearly all his life. So far as is known, he never took any steps to build or have built an engine working on the four-stroke cycle described in his pamphlet, though according to the article by Küster, cited previously, he started work on a hot-air engine. His claim to the invention of the four-stroke cycle appears to be well founded, as the cycle is clearly described in his pamphlet and no earlier references to it have ever been discovered. Giving credit to Beau de Rochas for the invention of the four-stroke cycle does not detract from the merits of Otto, whose great accomplishment it was to have developed and built in large numbers the world's first economical and smooth-running internal-combustion engine.

The first recognition given Beau de Rochas in his native land came in 1891 when, on the recommendation of M. Hirsch, of the Conservatory of Arts and Trades, the Society for the Encouragement of National Industry awarded him a grant of 3000 francs, referred to as a "Special Award in Mechanics for the Invention of the Four-Stroke Cycle." According to Professor Labarthe, Beau de Rochas died that same year, in May. In France the four-stroke cycle is now generally referred to as the "cycle Beau de Rochas" and the "bas relief," of which an illustration is reproduced herewith, will serve to keep alive the memory of this pioneer of the science of thermodynamics and of gas engines. It has been decided recently to place this bas relief in the Conservatory of Arts and Crafts in Paris and also to place a commemorative tablet of Beau de Rochas in the headquarters of the Society for the Encouragement of National Industry.

Tatra Automobiles Now a German Product

THROUGH the annexation of the Sudeten territory by Germany, the Tatra automobile works, manufacturers of the Tatra car, have become German. The principal stockholder is said to be Baron Ringhoffer, a Sudeten German. All three plants of the firm, in Nesselsdorf, Böhmisch Leipa, and Stauding, are now located in German territory. The Tatra Works, which in recent years turned out approximately 3000 cars annually, pioneered a number of important developments in automobile engineering such as independent suspension all around, the tubular backbone frame, and rear-mounted, air-cooled powerplants. There are also four motorcycle factories, in ceded Sudeten.

Welcome

On a tour of the metropolitan dealers' conventions on the Pacific Coast, C. P. Simpson (left) Pontiac's general sales manager stops off in Los Angeles to make a radio address on business conditions. Pictured in the courtyard of Columbia Square. CBS' Hollywood studios, chatting before a display arranged in his honor are Mr. Simpson; F. A. Berend, Pontiac's advertising manager; G. L. Moskovics of CBS; and A. G. Waddell, of McManus, John and Adams.

"Mail Order" Tractors In Low Price Field

With Sears, Roebuck & Co., and Montgomery Ward & Co., Chicago, the nation's largest mail order houses, entering the low-priced field of "riding" tractors for the first time this year, three Wisconsin manufacturers are receiving a substantial amount of new business.

The Simplicity Mfg. Co., Port Washington, Wis., maker of garage and machine shop tools and equipment, is manufacturing all of the Montgomery Ward tractors, which are being powered with engines made by the Wisconsin Motor Co. at Milwaukee. The Briggs & Stratton Corp., Milwaukee, a leading maker of automobile hardware, locks, etc., is manufacturing both the engines and transmissions for the Sears, Roebuck tractor, which is being assembled by an out-of-state firm.

W. J. Niederkorn, president of the Simplicity company, said that 500 tractors are in work at present for Montgomery Ward for the spring trade, with future output to be based on demand. The machine will be rated at 8 hp. It was developed during the past year for the Co-operative Verbundent of Sweden, which ordered 50 units. While Montgomery Ward will have exclusive domestic rights to the machine, foreign sales will be handled by Simplicity's own organization. The Port Washington firm entered the farm equipment field in 1937, after building engine rebuilding tools for 25 years. Two years ago it developed walking tractors, which the operator guides but does not sit on, for Montgomery Ward. About 2000 of these in 1, 2, and 5 hp. sizes have been built. Production in 1939 is expected to be about 4000 units.

Briggs & Stratton has been manufacturing farm power equipment since 1935 for Sears-Roebuck. In that year it developed an engine and transmissions for a single speed walking type tractor, and last year a larger size walker type with high, low and reverse gears was introduced. This year deliveries started on 5 hp. air-cooled, single cylinder engines and transmissions for the newly developed Sears-Roebuck riding type tractor. The firm expects to deliver 1000 of these assemblies in addition to 500 or more ½ hp. engines and transmissions for the walker type.

Reports are that the Sears-Roebuck riding type will be sold at $345, and the Montgomery Ward tractor will be sold at $369.

Japanese

(*Continued from page* 175)

American manufacturers instead of importing the vehicles via Japan as before. The few cars that are allowed to enter Japan after import permits have been obtained are immediately bought up by the Army, and there is no excess for reexports to the continent. Ford and Chevrolets imports into Manchuria last year totaled approximately 30,000 units, the highest figure in many years. In addition, nearly 1000 White and Indiana trucks were imported, which have not been seen in the Far East in such a large number for many years, it is reported.

Jap Parts Boycott Feeble

The boycott movement against Japanese goods organized by Chinese merchants in the Netherlands Indies, the Philippine Islands and other South Sea territories where the Chinese are an important factor in the retail trade has apparently not affected the sales of Japanese automobile and motor parts, a survey by Japanese authorities indicates.

Though the boycott was quite strong in the early months of the Sino-Japanese hostilities, many Chinese continued to import Japanese parts and accessories by designating Japanese banks as bankers and Japanese ships as carriers so as to camouflage the origin of the goods, the report claims.

Japanese trade returns indicate a sharp increase in the exports of automobile parts. Shipments during the first ten months of 1938 amounted to 8,358,000 yen ($2,280,000), compared with 4,772,000 yen (approximately $1,300,000) during the corresponding period of 1937.

A decrease was apparent in the exports of complete chassis, shipments of which slumped from 4,081,000 yen (approximately $1,114,000) to 1,759,000 yen (approximately $480,000). Exports of complete automobiles also decreased, from 1355 to 1003 for the first ten months of 1937 and 1938 respectively. All these cars were of the bantam type. There was also a substantial decrease in the shipments of tires, which during the first ten months of 1937 were exported to the value of 4,611,000 yen (approximately $1,259,000), but decreased to 3,719,000 yen (approximately $1,015,000) during the corresponding period of 1938.

Montreal Group's 25th Anniversary

The Montreal Automobile Trade Association Ltd., an organization formed in 1913 by a number of men engaged in various phases of the motor vehicle trade, is this year celebarting its silver anniversary, the 25th year of its existence. The creed of the association is "to promote confidence, trust and business-like relations among its various members and industries, and fair dealing with the outside world; to improve and elevate the business and promote the interests of the automobile industry in general." Among members prominently associated with the group are: G. O. Clermont, president; E. A. Everson, vice-president; P. N. Mainguy, secretary; C. S. Griffith and R. H. Pattison, directors.

Large Increase In December Air Travel

The Civil Aeronautics Authority reports that the scheduled air lines in the United States carried 89,921 revenue passengers during December, 1938, an increase of more than 55.45 per cent over the same period in 1937. The revenue passenger load factor for the month was 48.49 per cent, an increase of 17.66 per cent over the December, 1937, figure.

The airlines flew a total of 4,665,063 revenue plane miles and 37,366,805 revenue passenger miles, and carried 761,090 pounds of express for a total of 451,045,139 express pound miles during December, 1938.

Hydrogenation Activities in France

(*Continued from page* 190)

carried on with private capital but with financial assistance from the Government. The Government now has undertaken the organization of new hydrogenation plants with both private and Government capital and with loans guaranteed by it. The principal concern now engaged in carrying out these plans is the Compagnie Francaise de Raffinage, in which the Government is a large stockholder. It will erect two hydrogenation plants, one at Douges, a petroleum port on the Seine near Havre, where wastes from nearby refineries will be treated and which will have a capacity of 70,000 tons of gasoline per year; the other at Martigues near Marseilles, where both refinery wastes and lignite will be used as raw materials.

A third plant to be erected at Decazeville will work the Bethune or Audibert process of coal hydrogenation. Negotiations are pending with the International Hydrogenation Patents Co. for the installation of a plant at Paulignac in the Gironde. This company, it is said, will not ask for any investment by the Government but will ask it to contract for 100,000 tons of gasoline per year for a definite period. There is still another hydrogenation plant in France, operated entirely with private capital, by the Courrieres-Kuhlmann Co., which employs the Fischer-Tropsch low-pressure process.

Preventing Spring Surge

A NEW method of preventing surging of valve springs is reported from Germany. Valve springs usually have a natural frequency of vibration of from ten to twenty times the maximum speed of rotation of the camshaft, and it is harmonics of the force of valve acceleration from about the eleventh up that form the exciting forces for surge. Any particular harmonic of the valve-accelerating force naturally corresponds to the same harmonic of the valve-lift curve. By the method of harmonic analysis it is possible to determine the phase angles and amplitudes of the various harmonics of the valve-lift curve, and after such an analysis has been made, the cam outline can be so modified as to reduce the amplitudes of several of the higher harmonics to zero or practically zero. In a particular case, three successive harmonics were eliminated—harmonics which produced surge when the engine was running near the upper limit of its speed range—and trouble from spring surge prevented.

CHILTON ROUND TABLE

(*Continued from page* 184)

the legislatures of the various States pass laws imposing on retail and other local businesses, wage and hours regulation similar to that of the Federal Act.

From Commercial Car Journal

A large heavy-duty vehicle manufacturer is reported to be road testing some units which have disk type brakes at the rear wheels which supplement the more conventional system. The object is to relieve the regular set-up of a percentage of the braking effort and thus prolong brake life.

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BUYERS' GUIDE

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See Alphabetical List of Advertisers on page 32

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F. J. Littell Machine Co.

Alloy Steels, Cold Finished
Bliss & Laughlin, Inc.

Alloys
Bethlehem Steel Co.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Non-Ferrous
Dow Chemical Co. (Magnesium)

Arms & Knuckles, Steering
Atlas Drop Forge Co.
Park Drop Forge Co.

Auto Body Panels
Metal Auto Parts Co., Inc.

Axles
Atlas Drop Forge Co.
Park Drop Forge Co.
Union Drawn Steel Co. (Cold Drawn)

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Park Drop Forge Co.
Wyman-Gordon Co.

Brake Strand
Wickwire Spencer Steel Co.

Camshafts
Atlas Drop Forge Co.
Park Drop Forge Co.

Castings
Steel
Bethlehem Steel Co.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary

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Felt
American Felt Co.

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Park Drop Forge Co.
Wyman-Gordon Co.

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Felt
American Felt Co.

Fenders
Metal Auto Parts Co., Inc.

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Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Park Drop Forge Co.
Wyman-Gordon Co.

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Felt
American Felt Co.

Gear Boxes
Cotta Transmission Corp.

Gears, Reduction
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Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Sprng Corp.

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Flexible Metal Hose & Tubing Institute

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Metal Auto Parts Co., Inc.

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F. J. Littell Machine Co.

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Metal Auto Parts Co., Inc.

Rivets
Bethlehem Steel Co.

Running Board Shields
Metal Auto Parts Co., Inc.

Running Boards
Metal Auto Parts Co., Inc. (Metal)

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Wickwire Spencer Steel Co.

Screw Machine Products
Barnes Co., Wallace, Div. of Associated Spring Corp.

Screw Machines
Potter & Johnston Machine Co.

Screw Stock, Cold Drawn
Bliss & Laughlin, Inc.